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Noise Impact Assessment for a Proposed Residential Development

New Mount Street, Manchester

for:

CBRE Ltd.

SHF.1035.004.NO.R.002

'Experience and expertise working in union'

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Noise Impact Assessment for a Proposed Residential Development

Project:	New Mount Street, Manchester
For:	CBRE Ltd.
Status:	FINAL
Date:	December 2016
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Executive Summary

Enzygo has been instructed by CBRE Ltd., to prepare a noise assessment in support of a planning application for the conversion of commercial office spaces to residential dwelling apartments within the existing building envelope of a listed building at 23 New Mount Street, Manchester.

Within the scope of this assessment, noise levels have been quantified within the site for the purpose of determining the existing noise climate of the area. The climate is assessed in order to establish the suitability of the site for supporting residential living amenity.

The noise survey concluded that the noise climate of the area is affected by road and rail traffic noise sources, with further contributions from construction activity during the day.

Noise propagation and sound insulation modelling appears to indicate that existing glazing details would be suitable for reducing noise to meet current internal criteria. Windows may remain openable to provide short-term rapid and/or purge ventilation. Additional background ventilation details may be required to ensure windows do not require constant opening to provide fresh air through-flow.

Exposure contour modelling indicates that noise within rooftop terrace gardens would be considered sufficiently low as to support residential resting amenity. Proposed screening appears to provide the necessary noise control in order to reduce environmental noise levels to suitable magnitudes.

It is considered that, based upon the assessments undertaken within the scope of this report, the assumptions made and models constructed, the scheme demonstrates compliance with current guidance criteria for internal noise levels.

1 Introduction

1.1 Project Introduction

1.1.1 Enzygo Limited (Enzygo) have been commissioned by CBRE Ltd. to provide technical support to an application for the change of use of office spaces to residential apartments.

1.1.2 The purpose of this noise assessment is to evaluate the suitability of the site in terms of its ability to support residential resting and sleeping amenity. Where appropriate, outline mitigation strategies have also been recommended, but these would require further consideration within the detailed design of the site.

1.1.3 The assessment is based upon a noise measurement survey undertaken within the development site area between the 21st and 22nd July 2016.

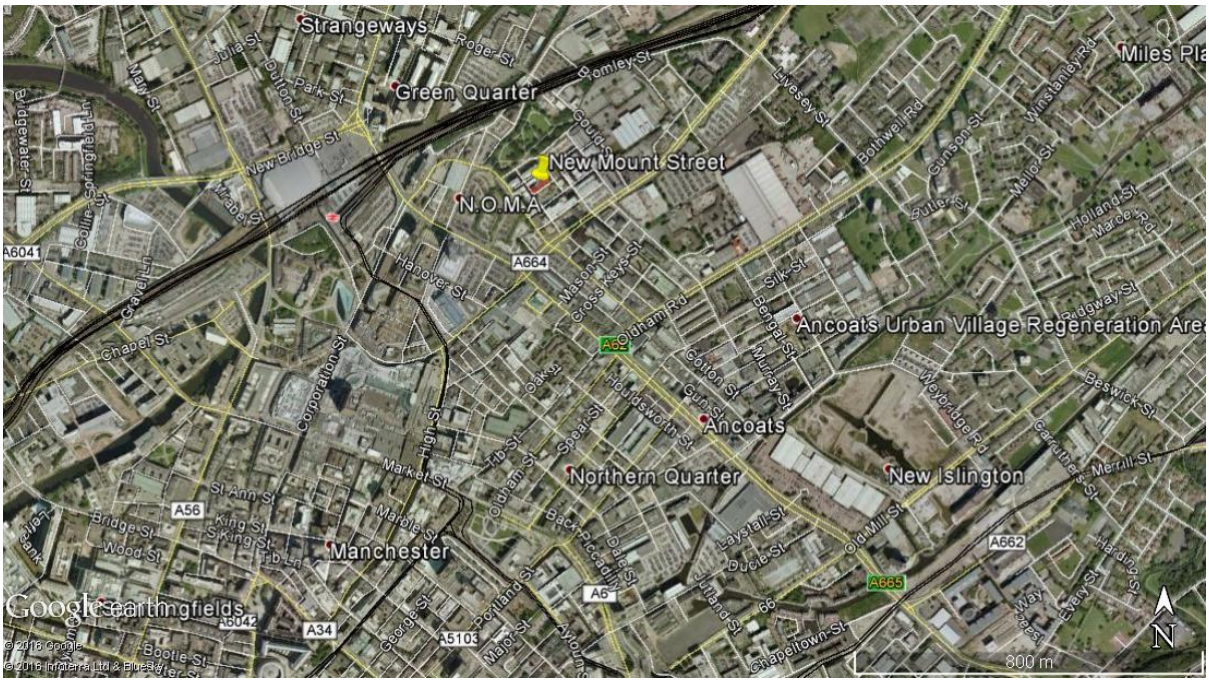
1.1.4 Details regarding the assessment methodology employed, together with the results of the survey undertaken and the subsequent conclusions drawn, are presented within the following report.

1.2 Site Description

1.2.1 The proposed development site is a Grade II-listed property fulfilling commercial (office) use at No. 23 New Mount Street, Manchester. The site is within the administrative area of Manchester City Council within the postcode area M4 4DE, and is centred at the approximate OS grid ref: SJ 84488 99082.

1.2.2 The site is located at the yellow pin, detailed within Figure 1-1 below.

Figure 1-1: Site Location Plan



(Image Source: Imagery ©2016 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2016 Google)

1.2.3 The area immediately surrounding the site is mixed commercial and residential, with the site located in the NOMA district of northern Manchester city centre. The classifications of the areas surrounding the site are as follows:

- Residential apartments are located immediately north of the site on Old Mount Street, with Angel Meadow parkland and the northern railway line beyond;
- Directly west of the site is a set of residential apartments on Rochdale Road (A665) with the New Angel Square commercial building beyond;
- To the south of the site is a small, ground-level car park with approximately 50 spaces and further residential apartments on Simpson Street/Dyche Street.
- Land to the east of the site is occupied by commercial premises, and residential apartments on School Street and Sharp Street.

1.3 Existing Site Use

1.3.1 The site is currently a set of Grade II-listed commercial office spaces. Current site elevations can be found in Appendix A.

1.4 Key Features of the Application

1.4.1 The application is to be of residential apartments, developed within the existing building envelope.

1.4.2 Three private rooftop terrace garden areas are proposed at the northern façade overlooking Naples Street.

1.5 Noise Assessment Methodology

1.5.1 In order to consider and assess the potential noise impacts at the site, a number of elements of work have been completed. These are detailed below:

- Completion of a noise survey to quantify the current baseline and ambient noise climate of the area;
- Noise modelling to calculate impact upon building façades and within rooftop gardens;
- Assessment and consideration of the suitability of the site for development of such a proposal;
- Where necessary, consideration of suitable acoustic mitigation measures and strategies that could be employed within the design of the site to control noise.

2 Standards and Guidance

2.1 Introduction

2.1.1 The assessment considers the building's ability to resist the passage of environmental noise to internal receptors. The following standards are deemed applicable to the assessment of noise at the development.

2.2 National Planning Policy Framework (NPPF, March 2012)

2.2.1 The NPPF determines the government's planning policy for England. The NPPF states that, with respect to noise, planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from a new development, including through the use of conditions;
- Recognise that development will often create some noise and existing business wanting to develop in continuance of their business should not have unreasonable restrictions put upon them because of changes in nearby land uses since they were established; and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.2.2 The guidance contained within the NPPF further determines that consideration should be given to the Noise Policy Statement for England (DEFRA, March 2010).

2.3 Noise Policy Statement for England (NPSE, March 2010)

2.3.1 The NPSE attends to three types of noise;

- "Environmental noise" which includes noise from transportation sources;
- "Neighbour noise" which includes noise from inside and outside people's homes; and
- "Neighbourhood noise", which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.

2.3.2 In line with the aims determined in the NPPF, the NPSE determines three aims;

1. 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;

2. 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; and,

3. 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.

2.3.3 The guidance detailed within the NPSE relates a number of key phrases with regards to adverse effects which can be applied to noise impacts as used by the World Health Organisation.

NOEL – No Observed Effect Level

The level below which no health effect or detrimental impact on the quality of life is observed.

LOAEL – Lowest Observed Adverse Effect Level

The level at which adverse effects on health and quality of life can be detected

SOAEL – Significant Observed Adverse Effect Level

The level above which significant adverse effects on health and quality of life occur.

2.3.4 The guidance indicates that it is not possible to have a single objective noise based measure that defines SOAEL, and as such the SOAEL is likely to be different for different noise sources and receptors. The document indicates that further research is required to establish what may constitute a significant adverse impact on health and quality of life from noise.

2.3.5 While the NPSE determines the NOEL, LOAEL and SOAEL descriptions the document indicates that, unlike other environmental disciplines, there are currently no European or national noise limits which have to be met although the NPSE states that "*there can be specific local limits for specific developments*" allowing for negotiation.

2.4 Planning Practice Guidance - Noise

2.4.1 The Planning Practice Guidance for noise (updated December 2014) broadly considers the same issues as demonstrated within both the NPPF and the NPSE with regards to noise within the planning realm.

2.4.2 The information detailed within the PPG indicates that noise should be considered when:

- New developments may create additional noise; and/ or,
- New developments would be sensitive to the prevailing acoustic environment.

2.4.3 The guidance indicates that Local Planning Authorities should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and,
- Whether or not a good standard of amenity can be achieved.

2.4.4 The impact of noise is rated within the policy document in terms of the relative '*Observed Effect Level*', defined in line with the criteria summarised within paragraph 3.3.3 above. Based

upon this the Planning Practice Guidance provides the following matrix of likely average response:

Table 2-1: Planning Practice Guidance – Noise; Exposure Hierarchy

Perception	Example of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and Intrusive	Noise can be heard and causes small changes in behaviour and/ or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/ or attitude, e.g. avoiding certain activities during periods of intrusion: where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/ or an ability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/ awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.5 British Standard 8233:2014 – 'Guidance on Sound Insulation and Noise Reduction for buildings'

2.5.1 When internal noise levels are required to be considered suitable guidance can be found within BS 8233:2014.

2.5.2 This Standard provides guidance values within Section 7.7 relating to a range of design criteria levels for certain building types. Section 7.7.1 covers "*Dwelling Houses, flats and rooms in residential use (when unoccupied)*" and the appropriate values are presented within Table 2- below.

Table 2-2: BS 8233 Guidance Values

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

2.5.3 Note 7 to the above table within BS 8233 details that *"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved"*.

2.5.4 With regard to external noise levels the Standard states that *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments"*. However, the Standard recognises that these levels are not achievable in all situations and further states that *"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"*.

2.5.5 The internal values detailed within the scope of BS 8233: 2014 generally accord well with the recommendations of the WHO guidance.

2.6 The World Health Organisation Guidelines for Community Noise (1999)

2.6.1 The World Health Organisation's (WHO) '*Guidelines for Community Noise*' report for external environmental noise levels states that;

"4.2.7 Annoyance responses

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10dB lower than during the day…."

2.6.2 For night-time noise sources the WHO guidelines recommend a night-time (23:00 – 07:00) 8-hour noise level of 30 dB L_{Aeq} inside bedrooms (for reasonably steady noise source) to avoid sleep disturbance. However, this has been somewhat superseded by the more recent Night Noise Guidelines for Europe (2009) as detailed in Section 3.8.

2.6.3 For internal noise levels during the daytime and evening period it is suggested that a noise level of 35 dB $L_{Aeq,16hr}$ (07:00 – 23:00hrs) be achieved within habitable rooms to avoid speech intelligibility and moderate annoyance.

2.7 World Health Organisation: Night Noise Guidelines for Europe (2009)

2.7.1 The '*Night Noise Guidelines for Europe*' were published by the WHO in 2009 and works in association with the 2000 Guidelines for Community Noise.

2.7.2 The guidance also states that;

"Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,\ outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night,\ outside}$ of 40 dB should be the target of the night noise guidelines (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly."

2.7.3 The document accords well with the 'Good' internal design criteria as defined within BS 8233 when windows are open for ventilation.

2.8 Consultation with Manchester City Council

2.8.1 Following communique between Enzygo and Ms. Sue Jones of Manchester City Council, the following criteria is deemed as appropriate for the assessment of noise at the site:

- "Bedrooms (night time - 23.00 - 07.00) – 30 dB L_{Aeq} (individual noise events shall not normally exceed 45 dB $L_{Amax,F}$ by more than 15 times)"
- "Living Rooms (daytime - 07.00 - 23.00) – 35 dB L_{Aeq}"

2.8.2 Criteria accord closely with those within BS 8233:2014, and measurements taken during site visits include both morning and afternoon 'rush hour' periods. Night-time values have been measured during either the first or last hour periods of the 23:00-07:00 window, and as such are also deemed as peak noise times.

3 Noise Monitoring Survey

3.1 Introduction

3.1.1 This section of the report describes the specifics of the noise survey undertaken in connection with the study.

3.2 Baseline Survey Details

3.2.1 In order to determine the ambient noise climate at the building façades and to provide a framework for impact assessment, measurements were conducted at the locations listed below, with periodic attendance. Measurements were undertaken between 16:43 on 21st July and 09:05 on 22nd July 2016.

Table 3-1: Noise Monitoring Locations

Location Reference	Grid Ref (NGR)	Description
M01	SJ 84490 99073	New Mount Street, overlooking car park
M02	SJ 84488 99110	Corner junction between Naples Street and School Street
M03	SJ 84453 99072	Ludgate Street, overlooking rear of 10 Naples Street

3.2.2 The onsite noise monitoring location is presented graphically within Figure 3-1 below.

Figure 3-1: Onsite Noise Monitoring Location plan



(Image Source: Imagery ©2015 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2015 Google)

3.2.3 The noise monitoring survey was undertaken via short-term, periodic monitoring over morning, afternoon and night-time periods, as detailed in Table 3-2 below.

Table 3-2: Noise Monitoring Durations

Location	Meter	Period	Duration (hh:mm:ss)	Times
M01	01dB Solo 65445	Periodic Noise Monitoring	01:25:00	(21/07/2016) 17:26-17:51; 23:40-00:00 (22/07/2016); 06:52-07:17; 07:58-08:18
M02			01:35:00	(21/07/2016) 16:43-17:08; 22:54-23:19; (22/07/2016) 07:13-07:38; 08:19-08:44
M03			01:40:00	(21/07/2016) 17:05-17:30; 23:17-23:42; (22/07/2016) 07:36-08:01; 08:40-09:05

3.2.4 Levels were measured over typical working days (Thursday/Friday), include both morning and afternoon rush hour periods, and the two peak activity night-time periods between 23:00-00:00/06:00-07:00.

3.3 Weather Conditions

21st July 2016

3.3.1 Meteorology during the afternoon measurement was warm and dry, with complete cloud cover, temperatures of 21˚C and negligible wind. Roads were dry and ground firm.

Night-time meteorology was noted as being 18˚C, with no precipitation or wind. Road and ground surfaces remained dry and firm.

22nd July 2016

3.3.2 Early morning weather was mild and dry, with no precipitation. Roads remained dry overnight and ground was still noted to be firm. Wind was noted from a southerly direction, at around 0.5m/s^{-1}, and temperatures logged at 17˚C.

3.4 Monitoring Equipment

3.4.1 The monitoring was undertaken in line with the guidance set out within BS 7445: 1991, with the sound level meters programmed to monitor continuously, recording the following statistical parameters:

- L_{eq} in dB
- L_{10} in dB
- L_{90} in dB
- L_{max} in dB

3.4.2 The following noise monitoring equipment was used in order to undertake the survey work within the site.

Table 3-3: Noise Monitoring Equipment

Equipment	Manufacturer	Type	Serial Number
Sound Level Meter	01dB	Solo Black	65445
Calibrator	Cirrus	CR:515	67243

3.4.3 The following set-up parameters were used on the sound level meters during all of the noise measurements undertaken:

Time Weighting: Fast

Frequency Weighting: "A"

3.4.4 The sound level meter used within this assessment was locally calibrated using an electronic calibrator prior to commencement and upon completion of the survey, no significant drift in calibration was observed as detailed below:

Table 3-4: Local Survey Calibration Record

Sound Level Meter	Overall Survey	
	Start	End
Solo 65445	94.1dB	94.1dB

3.4.5 Equipment laboratory calibration certificates are available on request.

4 Noise Survey Results

4.1 Introduction

4.1.1 This section of the report summarises the results of the noise monitoring survey undertaken within the scope of this assessment. The full monitoring dataset is presented in Appendix B of this report.

4.2 On-site Noise Monitoring Survey Results

4.2.1 Presented within Table 4-1 below is a summary of the daytime and night-time noise levels monitored within the site at the locations detailed within section 3.

- The daytime data is presented as the average of the 5-minute noise levels monitored during the daytime periods between 07:00 to 23:00;
- The night-time data is presented as the average of the 5-minute levels monitored during the overnight periods between 23:00 to 07:00.

Table 4-1: Onsite Noise Monitoring Levels

Location	Period	dB L_{Aeq}	dB L_{AFmax}	dB L_{A90}	dB L_{A10}
M01	Daytime	56.0	76.9	49.7	57.9
	Night-time	48.8	67.8	43.2	49.9
M02	Daytime	58.4	71.9	51.9	61.0
	Night-time	49.4	59.1	44.6	52.3
M03	Daytime	55.4	74.8	50.6	57.8
	Night-time	53.0	75.0	47.7	53.7

4.2.2 In the interest of presenting the worst-case scenario, daytime noise is shown as an average of the morning and afternoon rush hour periods, night-time noise is presented as the average of the two peak night-time periods (23:00-00:00; 06:00-07:00).

4.3 Subjective Field Notes

Noise during the afternoon at location M01 was noted from parking vehicles and traffic activity from local and distant road infrastructure. Secondary sources were noted from residents on nearby balconies. Night noise sources included distant road traffic activity, and barely perceptible plant noise (unknown source). Morning sources were from parking vehicles, distant and local road activity.

At location M02, rail and road noise were noted as the predominant afternoon noise sources, with passing pedestrians identified as secondary sources. Train noise dominated during the evening/night-time period. Morning noise sources included road and rail vehicle activity.

Afternoon noise sources were noted to be primarily from traffic on local and distant road infrastructure, with secondary contributions from a distant fan (or other aerodynamic plant). Night-time noise was recorded from road and rail vehicles, with road noise dominated. Morning noise was noted from road and rail sources, but with additional contributions from construction activities within the building adjacent.

5 Noise Modelling

5.1 Introduction

5.1.1 A noise model has been constructed in order to determine the magnitude of environmental noise at the façades of the development site.

5.1.2 Glazing modelling has been undertaken to ascertain values of sound reduction for existing sash window elements.

5.1.3 This section outlines the protocols, methods and assumptions upon which this model has been constructed.

5.2 Environmental Noise Modelling Rationale

5.2.1 The model has been constructed using the commercially available Braunstein + Berndt GmBH noise mapping software SoundPLAN v7.4.

5.2.2 Within the scope of this modelling exercise, acoustic propagation has been calculated in accordance with the following standards:

- Planning Policy Guidance 24, and;
- ISO 9613-2: Acoustics – Attenuation of sound during outdoor propagation outdoors: Part 2: General method of calculation.

5.2.3 Noise modelling was carried out using the following information:

- Current Google Earth aerial satellite photography, and;
- Current Google Earth topographical (spot height) data.

5.2.4 Levels of noise at each façade are represented graphically, and are indicated within Appendix C.

5.2.5 A detailed matrix of façade levels per elevation has been included in the following section of this report.

5.3 Environmental Noise Modelling Assumptions

5.3.1 Noise modelling has been constructed with sources from road (A665, A664 and local roads), rail and car parking; this accords with the primary sources identified by the engineer during the site visit.

5.3.2 A 1.8m screen has been assumed for the purposes of the model, accounting for screening detail for rooftop garden areas (0.8α absorption).

5.3.3 In order to 'balance' modelled levels, noise sources have been calculated in order to achieve the maximum level of correlation possible with those measured on site. The table below indicates source levels, free field levels at the receiver locations, and tolerances to those levels measured on site during the site visit:

Table 5-2: Noise Model Tolerances

Location	Period	Measured Receiver dB L_{Aeq}	Modelled Receiver dB L_{Aeq}	Tolerance (±dB)
M01	Daytime	56.0	56.1	0.1
	Night-time	48.8	48.8	0.0
M02	Daytime	58.4	58.4	0.0
	Night-time	49.4	49.1	0.3
M03	Daytime	55.4	55.5	0.1
	Night-time	53.0	53.1	0.1

5.3.4 It is noted from the data above that tolerances are within 1dB, therefore deemed representative of noise levels measured at the site during the noise survey site visit.

5.4 Insulation Modelling Rationale and Assumptions

5.4.1 A sound insulation model has been constructed in order to calculate the levels of sound reduction afforded by existing glazing elements at the site.

5.4.2 Glazing Sound Reduction Indices have been modelled using the commercially available Marshall Day sound insulation modelling software Insul V8.0.9.

5.4.3 Modelling has been carried out according to ISO 717-1:2013 'Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation'.

5.4.4 A model has been constructed on an assumed specification of:

- 6mm single-glazed windows
- Assumed dimensionality of 1m x 1.5m
- 2mm gap to account for sash frames tolerances.

5.4.5 Although it is noted that some windows do not appear to be sash frames, the 2mm gap is retained to account for misfitting or potential weaknesses in frames. This preserves the presentation of a worst-case scenario when assessing glazing acoustic reductions.

5.4.6 Octave band sound reductions are shown below:

Table 5-3 Modelled Glazing Reductions

Frequency (Hz)	63	125	250	500	1000	2000	4000	R_w
Sound Reduction Index (dB R)	13	18	23	27	32	30	35	30

5.4.7 A figure of 30dB R_w has therefore been calculated to represent acoustic reductions from closed windows at the site.

5.4.8 Appendix C presents the output from the insulation modelling software.

6 Noise Impact Assessment

6.1 Introduction

6.1.1 In this section of the report, the potential noise impacts on residential aspects of the development have been assessed and considered in accordance with relevant criteria and guidance as summarised in Section 2.

6.1.2 As previously discussed, the NPPF (National Planning Policy Framework) supersedes the guidance of PPG24, and the suitability of a site for residential development is therefore assessed against the specific criteria set out in BS 8233 and the WHO Community Noise Guidelines.

6.2 Rationale

6.2.1 This assessment determines that due to the build-up detailing of external walls (brick/masonry), façade insulation levels are to be governed by glazing; the weakest acoustic reduction element within the façade.

6.2.2 Glazing reductions are shown from those modelled and presented in Section 5 (30dB R_w).

6.2.3 It should be noted that the south-eastern-facing elevation (Elevation 1) presents a single façade, whereas at all other elevations, this is not the case.

6.2.4 This report references the elevations as per current drawings, shown in Appendix A.

6.3 Residential Internal Noise Assessment – Daytime

6.3.1 The table below highlights calculated daytime noise levels at each elevation floor:

Table 6-1: Daytime Façade Noise Levels

	Elevation 1	Elevation 2	Elevation 3	Elevation 4
Floor	**dB $L_{Aeq, 16hr}$**	**dB $L_{Aeq, 16hr}$**	**dB $L_{Aeq, 16hr}$**	**dB $L_{Aeq, 16hr}$**
GF	53.7	51.3	57.0	56.0
1F	54.5	51.8	58.3	54.1
2F	54.7	52.7	50.9	53.5
3F	54.6	53.4	53.2	53.3
4F	54.4	53.7	55.1	53.3

6.3.2 BS 8233 states that internal noise levels, in such circumstances, should not exceed 35dB $L_{Aeq, 16hr}$ during the day in living rooms, or 40dB $L_{Aeq, 16hr}$ in dining rooms.

6.3.3 A reduction of 30dB R_w from glazing would be deemed as sufficient to reduce noise for internal receptors as to meet both living room (35dB $L_{Aeq, 16hr}$) and dining room (40dB $L_{Aeq, 16hr}$) internal ambient noise criteria.

6.3.4 Open windows may provide reductions of up to 15dB R_w, and although suitable for temporary rapid/purge ventilation, additional ventilation systems may be deemed required.

6.3.5 Passive through-wall ventilators should sufficiently provide the necessary background ventilation without the need for opening windows.

6.4 Residential Internal Noise Assessment – Night-time

6.4.1 Night-time noise levels have been calculated at the façades of each elevation, and noise values are shown below:

Table 6-2: Night-time Façade Noise Levels

	Elevation 1	Elevation 2	Elevation 3	Elevation 4
Floor	**dB $L_{Aeq, 8hr}$**	**dB $L_{Aeq, 8hr}$**	**dB $L_{Aeq, 8hr}$**	**dB $L_{Aeq, 8hr}$**
GF	47.3	42.4	49.7	46.7
1F	48.7	42.7	47.1	47.4
2F	41.3	43.8	46.2	47.4
3F	43.1	44.4	45.8	47.3
4F	44.9	44.8	45.5	47.0

6.4.2 Night-time noise would be sufficiently reduced as a result of closed windows, and would likely meet the 30dB $L_{Aeq, 8hr}$ criterion.

6.4.3 Maximum noise levels would also benefit from glazing reduction, and would be attenuated from current levels of 75.0dB to 45.0dB L_{AFmax}; demonstrating compliance with the criterion at the maximum-exposed façade.

6.4.4 Open windows may provide up to 15dB R_w, enabling noise to remain close to the 30dB criterion, however, it may be deemed necessary to provide additional background ventilation to ensure windows can remain closed.

6.4.5 A passive through-wall ventilation unit may help provide the desired background ventilation, without compromising glazing visual outlook.

6.5 Residential External Noise Assessment

6.5.1 Three private rooftop terrace gardens are located on the current drawings, at the north-western corner of the site, overlooking Naples Street.

6.5.2 Gardens are described as privacy-screened, with a biodiverse green roof system located on the western side of the garden area.

6.5.3 The noise map output shown in Appendix C Figure 7 indicates that:

- Areas of all three gardens have amenity space within the 55dB L_{Aeq} BS 8233:2014 criterion for outdoor living areas.
- The vast majority of each space achieves a level not higher than 56dB L_{Aeq}.
- All three spaces achieve a maximum exposure level of no higher level than 58dB L_{Aeq}.

6.5.4 It is deemed that outdoor living spaces (private rooftop terrace gardens) will be exposed to sufficiently low noise levels as to support conditions suitable for daytime resting.

6.5.5 It is recommended for acoustic purposes to ensure that screening has a good seal at the connection between the floor and screen, in order to prevent noise transmission. Screening should aim to be contiguous, having no gaps or fissures for noise to pass through.

6.5.6 A noise barrier is most effective for sound sources with lateral propagation, such as road or rail noise, construction noise, etc. Its uses are limited for reducing noise from aircraft, however in this case, no aircraft noise was considered a significant contributor to the overall sound climate.

6.6 Grade Listing Status

6.6.1 It is understood that the building currently holds a Grade II Listed status, and that any alterations made to the building envelope may require prior consultation.

6.6.2 It is recommended that ventilation systems (should they be deemed a requirement) should first be discussed between the client and the local authority in order to preserve the visual outlook.

6.6.3 Placement, size and equivalent ventilation area should be discussed when selecting appropriate details.

6.6.4 Rooftop garden areas are proposed at an area of the site without grade listing.

7 Conclusion

7.1 Background

7.1.1 A noise assessment has been completed for submission to Manchester City Council in support of a planning application for a residential development of the former office spaces at No. 23 New Mount Street, Manchester.

7.1.2 The general character of the area has been quantified as being commercial/industrial, with primary noise contribution from road/rail vehicle movement and parking noise.

7.2 Internal Noise Assessment

7.2.1 Façade insulation from current building elements would sufficiently reduce external noise to internal noise criteria during both daytime and night-time periods. Open windows may provide suitable temporary conditions for rapid or purge ventilation, however it may be deemed necessary to introduce additional passive through-wall ventilators. These should be confirmed with the relevant authorities as to their visual suitability with specific regard to the building's Grade II Listing status.

7.3 External Noise Assessment

7.3.1 Rooftop garden areas appear to support amenity spaces that largely meet the BS 8233:2014 ≤55dB L_{Aeq} criterion for external daytime resting conditions. It is deemed that the outdoor spaces proposed would be suitable for such purposes, in the context of a city centre location, provided the proposed screening is implemented.

7.4 General Conclusion

7.4.1 Overall it is considered that there are no significant issues associated with the proposed residential development that would preclude the development from being granted planning permission on grounds of noise. This is subject to the implementation of appropriate planning conditions to ensure noise is suitably considered at all stages of the development.

REFERENCES

Department for Communities and Local Government – National Planning Policy Framework, March 2012.

Department for Environment, Food and Rural Affairs – Noise Policy Statement for England, March 2010.

British Standards Institution. British Standard 4142: 'Methods For Rating And Assessing Industrial And Commercial Sound', 2014.

British Standards Institution. British Standard 8233: 'Guidance on Sound Insulation and Noise Reduction for Buildings', 2014.

British Standards Institution. British Standard 7445-2 (ISO 1996-2:1987): 'Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use', 1991.

The World Health Organisation (WHO) Guidelines for Community Noise, 2000

World Health Organisation (WHO) Night Noise Guidelines for Europe, 2009

GLOSSARY OF TERMS

Noise is defined as unwanted sound. The range of audible sound is taken to be from 0 dB to 140 dB. Examples of typical noise levels relating to 'everyday' occurrences are presented within 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 about 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 the 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 measurements.

For variable noise sources within an area an increase of 3 dB(A) would be considered to be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10 dB(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 regard 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. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of 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 in order 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 10th 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 90th 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 sources incident at one location, both in the near- and far-field (*The ambient sound comprises the residual sound and the specific sound when present)*.
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: $$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.

Term	Definition
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of a number of non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over a period of time, T.
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (*This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h*).
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.

Appendix A – Current Site Elevations

Figure A-1: Current Site Elevation 1

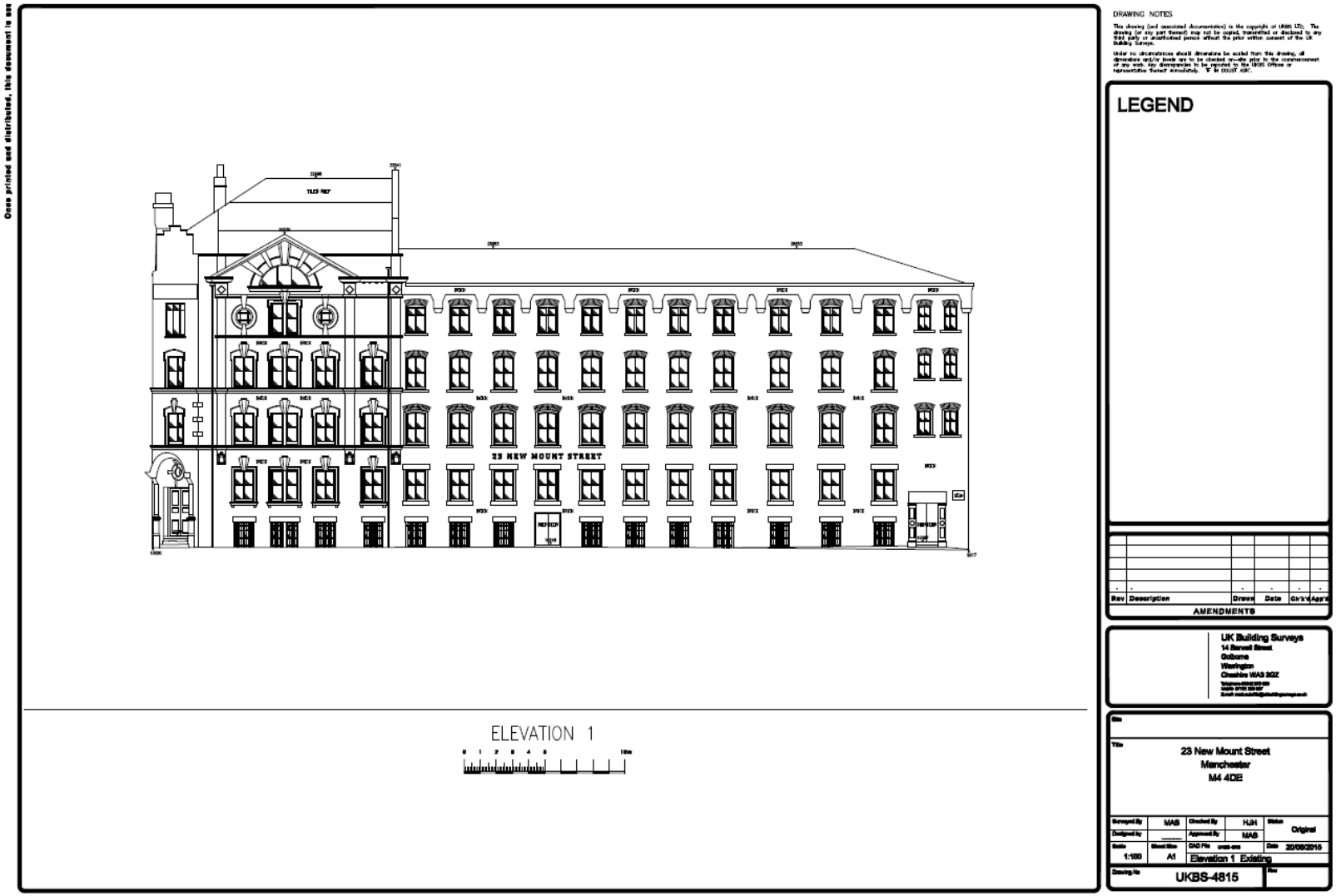


Figure A-2: Current Site Elevation 2



Figure A-3: Current Site Elevation 3

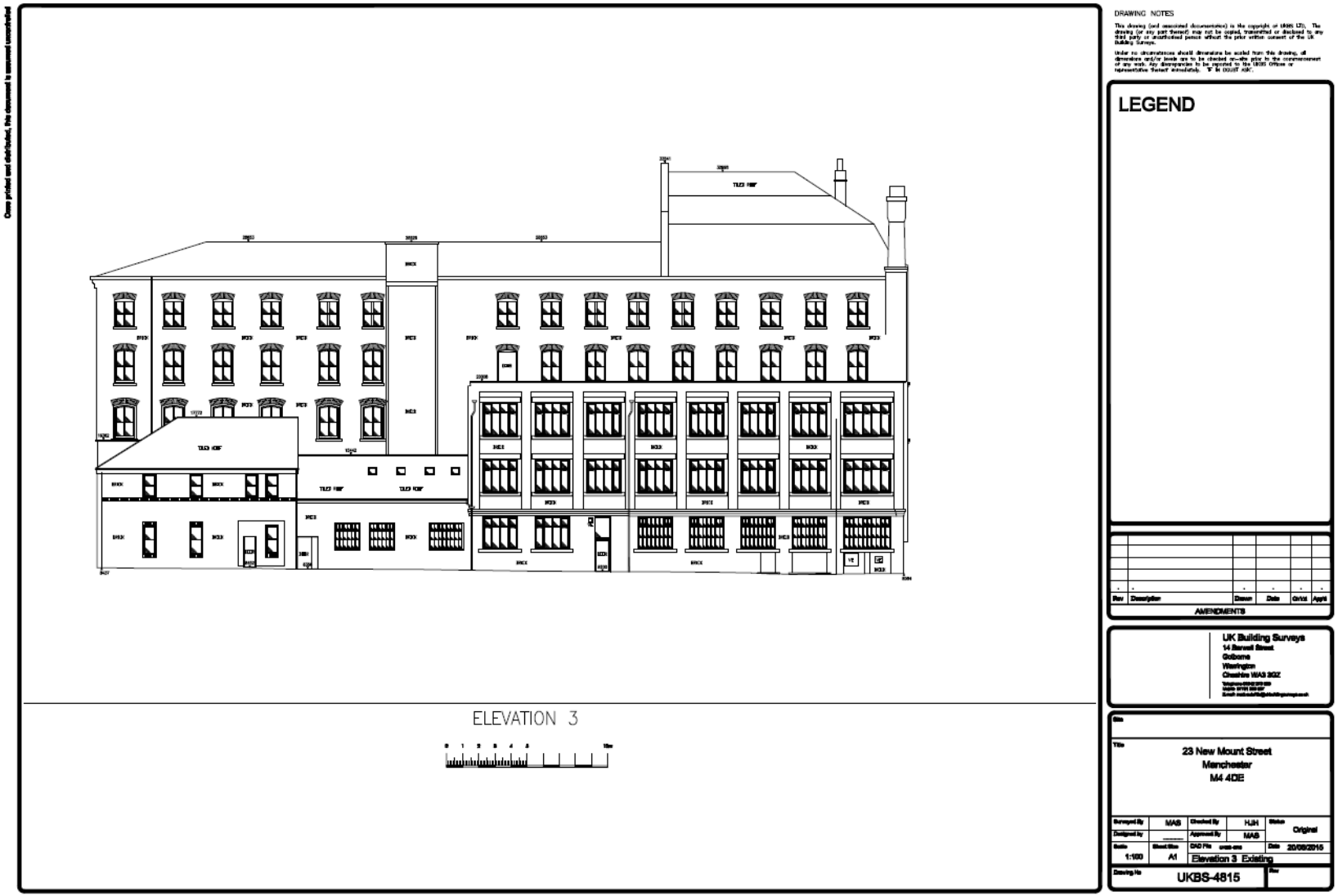
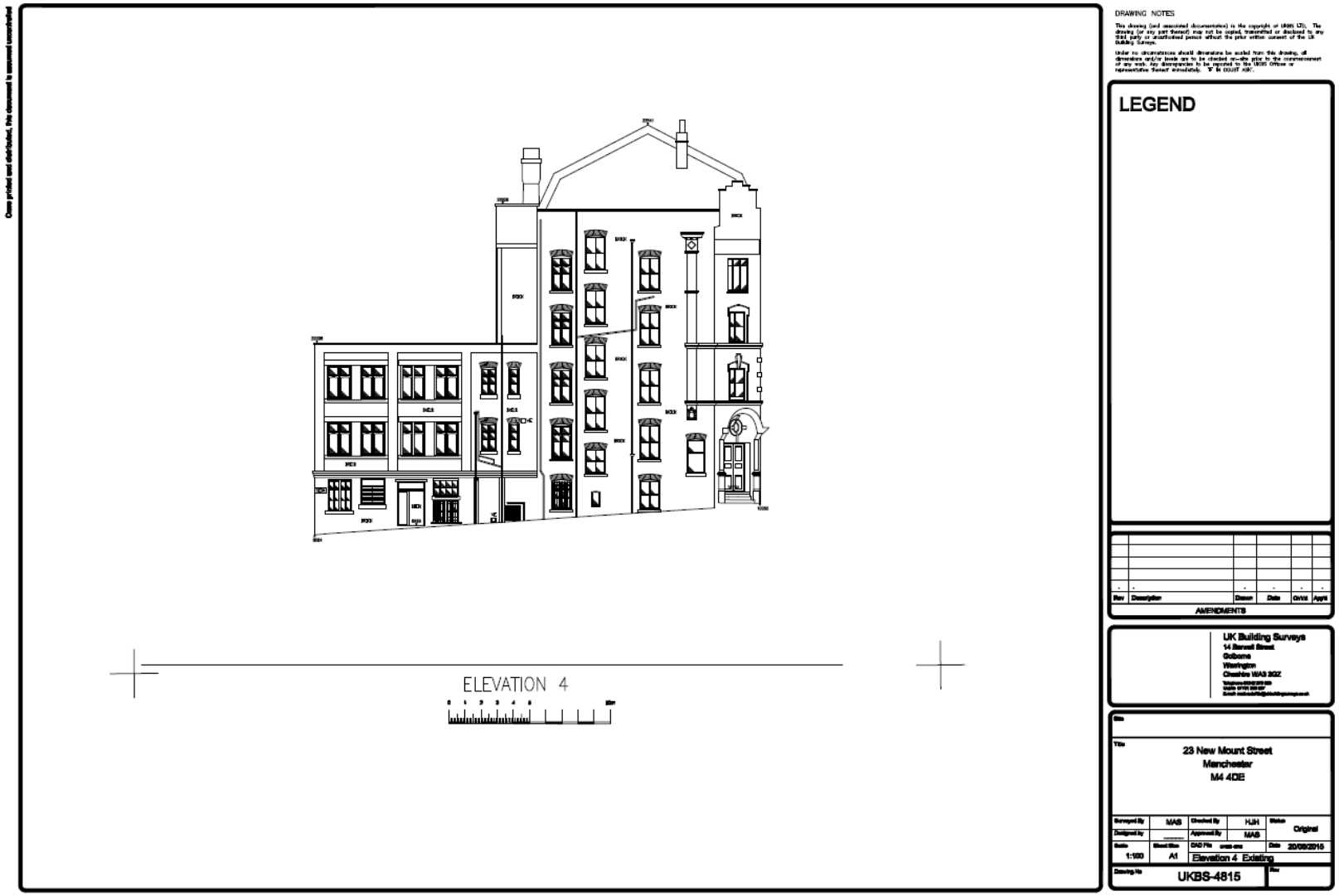


Figure A-4: Current Site Elevation 4


Once printed and distributed, this document is assumed uncontrolled
ELEVATION 4
DRAWING NOTES
LEGEND
AMENDMENTS
UK Building Surveys
14 Barwell Street
Golborne
Warrington
Cheshire WA3 3GZ
23 New Mount Street
Manchester
M4 4DE
MAS
HJH
MAS
Original
1:100
A1
20/08/2015
Elevation 4 Existing
UKBS-4815

Appendix B – Noise Monitoring Data

Table B-1: Noise Monitoring Data M01

File	065445_160721_172652000.CMG			
Periods	5m			
Start	21/07/2016 17:26			
End	21/07/2016 17:51			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
21/07/2016 17:26	52.7	62.3	48.4	55.6
21/07/2016 17:31	59.9	66.9	50.9	61.1
21/07/2016 17:36	57.4	69.0	50.0	61.2
21/07/2016 17:41	56.8	72.8	50.4	59.2
21/07/2016 17:46	51.6	58.1	49.3	52.9
Overall	**57.2**	**72.8**	**49.3**	**59.4**
File	065445_160721_233939000.CMG			
Periods	5m			
Start	21/07/2016 23:40			
End	22/07/2016 00:00			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
21/07/2016 23:40	45.5	53.7	41.8	48.3
21/07/2016 23:45	44.0	50.1	41.5	45.5
21/07/2016 23:50	48.9	64.0	42.0	50.4
21/07/2016 23:55	43.8	50.9	40.8	45.6
Overall	**46.1**	**64.0**	**41.4**	**47.0**

File	065445_160722_065215000.CMG			
Periods	5m			
Start	22/07/2016 06:52			
End	22/07/2016 07:17			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
22/07/2016 06:52	48.9	61.8	44.7	51.1
22/07/2016 06:57	48.2	58.6	43.9	50.1
22/07/2016 07:02	50.3	62.1	44.8	52.3
22/07/2016 07:07	51.2	60.5	46.4	54.8
22/07/2016 07:12	55.1	67.8	46.7	56.0
Overall	**50.4**	**67.8**	**44.9**	**52.7**
File	065445_160722_075815000.CMG			
Periods	5m			
Start	22/07/2016 07:58			
End	22/07/2016 08:18			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
22/07/2016 07:58	54.1	62.5	49.6	56.9
22/07/2016 08:03	55.1	68.1	49.7	57.8
22/07/2016 08:08	54.0	65.2	50.8	55.1
22/07/2016 08:13	53.2	64.3	50.2	55.0
Overall	**54.2**	**68.1**	**50.0**	**56.4**

Table B-2: Noise Monitoring Data M02

File	065445_160721_164307000.CMG			
Periods	5m			
Start	21/07/2016 16:43			
End	21/07/2016 17:08			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
21/07/2016 16:43	55.9	67.2	50.3	59.0
21/07/2016 16:48	55.5	67.7	49.3	59.5
21/07/2016 16:53	55.4	69.9	49.8	55.7
21/07/2016 16:58	56.7	68.2	49.6	59.0
21/07/2016 17:03	55.9	64.4	49.4	61.0
Overall	**55.9**	**69.9**	**49.6**	**58.7**
File	065445_160721_225412000.CMG			
Periods	5m			
Start	21/07/2016 22:54			
End	21/07/2016 23:19			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
21/07/2016 22:54	50.5	58.7	45.3	53.0
21/07/2016 22:59	48.7	57.5	44.9	51.3
21/07/2016 23:04	48.9	58.5	44.0	51.7
21/07/2016 23:09	49.8	59.1	44.4	52.9
21/07/2016 23:14	47.2	54.0	44.3	49.5
Overall	**49.4**	**59.1**	**44.6**	**52.3**

File	065445_160722_071355000.CMG			
Periods	5m			
Start	22/07/2016 07:13			
End	22/07/2016 07:38			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
22/07/2016 07:13	56.1	68.5	49.8	57.6
22/07/2016 07:18	54.1	66.5	49.7	56.4
22/07/2016 07:23	53.6	63.4	49.4	55.7
22/07/2016 07:28	57.1	72.4	50.0	58.0
22/07/2016 07:33	53.4	57.5	50.1	55.8
Overall	**55.4**	**72.4**	**49.8**	**56.8**
File	065445_160722_081946000.CMG			
Periods	5m			
Start	22/07/2016 08:19			
End	22/07/2016 08:44			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
22/07/2016 08:19	59.2	71.4	54.7	61.3
22/07/2016 08:24	57.0	64.4	53.7	59.3
22/07/2016 08:29	60.1	71.9	55.3	62.5
22/07/2016 08:34	62.1	71.1	54.1	65.2
22/07/2016 08:39	63.1	66.1	58.7	65.0
Overall	**60.0**	**71.9**	**54.2**	**63.2**

Table B-3: Noise Monitoring Data M03

File	065445_160721_170537000.CMG			
Periods	5m			
Start	21/07/2016 17:05			
End	21/07/2016 17:30			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
21/07/2016 17:05	58.5	71.3	53.5	60.9
21/07/2016 17:10	57.0	74.0	52.5	57.9
21/07/2016 17:15	56.8	68.8	51.5	58.8
21/07/2016 17:20	57.0	68.7	52.2	59.4
21/07/2016 17:25	56.5	58.8	52.9	58.2
Overall	**57.4**	**74.0**	**52.3**	**59.0**
File	065445_160721_231713000.CMG			
Periods	5m			
Start	21/07/2016 23:17			
End	21/07/2016 23:42			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
21/07/2016 23:17	55.0	75.0	47.4	55.3
21/07/2016 23:22	51.4	56.6	48.0	53.7
21/07/2016 23:27	54.4	71.1	48.0	54.0
21/07/2016 23:32	50.1	61.8	47.4	52.0
21/07/2016 23:37	50.1	58.7	47.9	52.3
Overall	**53.0**	**75.0**	**47.7**	**53.7**

File	065445_160722_073610000.CMG			
Periods	5m			
Start	22/07/2016 07:36			
End	22/07/2016 08:01			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
22/07/2016 07:36	49.9	62.2	47.1	51.9
22/07/2016 07:41	50.9	62.8	47.6	52.8
22/07/2016 07:46	56.1	69.8	47.9	58.4
22/07/2016 07:51	52.9	64.2	48.2	55.2
22/07/2016 07:56	51.2	56.7	48.8	52.7
Overall	**53.0**	**69.8**	**47.6**	**54.3**
File	065445_160722_084053000.CMG			
Periods	5m			
Start	22/07/2016 08:40			
End	22/07/2016 09:05			
Location	Solo 065445			
Weighting	A			
Data type	Leq			
Unit	dB			
Period start	**Leq**	**Lmax**	**L90**	**L10**
22/07/2016 08:40	53.7	64.4	48.4	55.9
22/07/2016 08:45	57.3	74.8	51.1	60.2
22/07/2016 08:50	52.8	62.1	48.6	55.2
22/07/2016 08:55	53.2	63.7	48.8	55.8
22/07/2016 09:00	50.9	52.3	49.5	52.2
Overall	**54.7**	**74.8**	**48.8**	**56.6**

Appendix C – Modelling Outputs

Figure C-1: 3D Façade Output – Elevation 1 & 4 Daytime

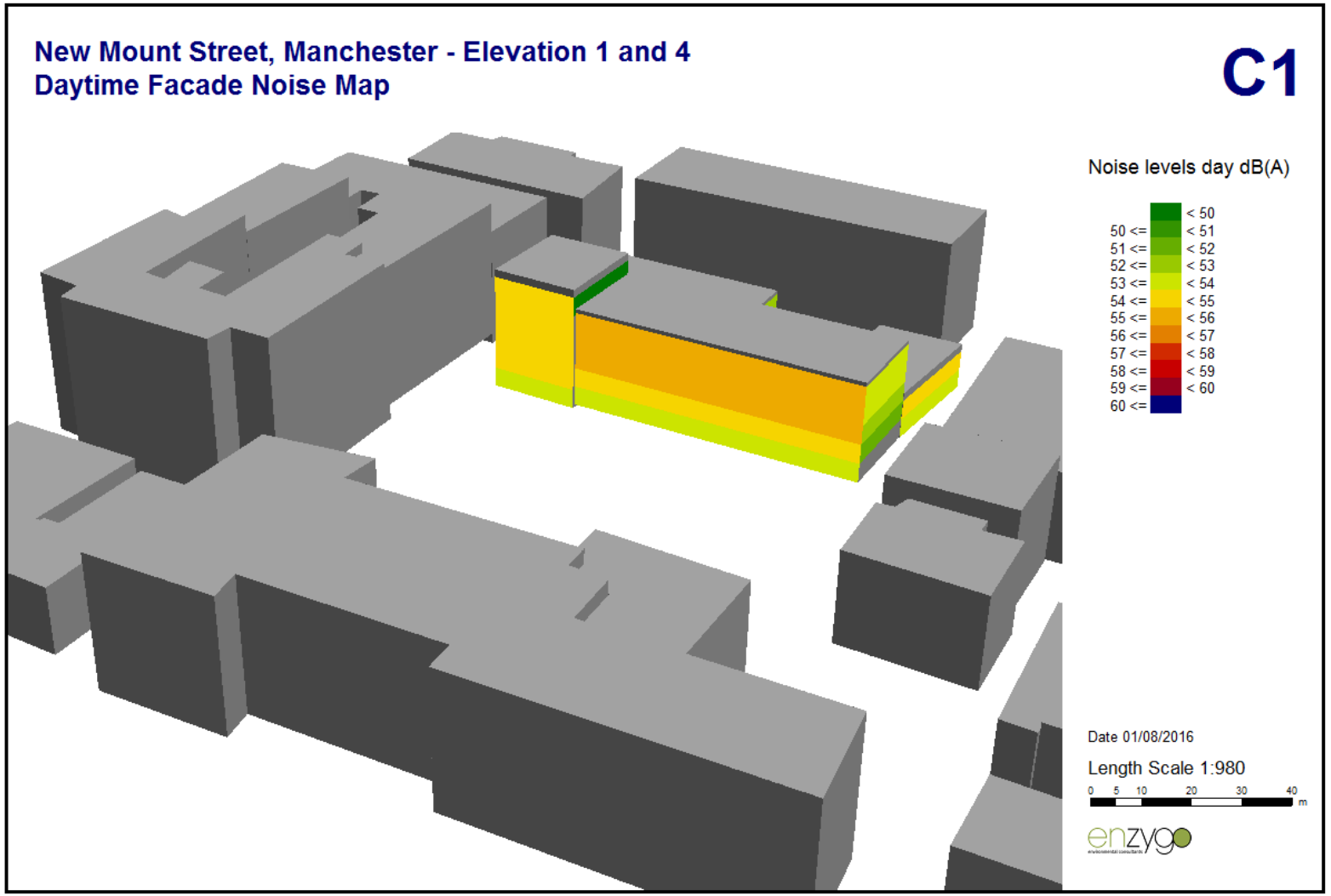


Figure C-2: 3D Façade Output – Elevation 1 & 4 Night-time

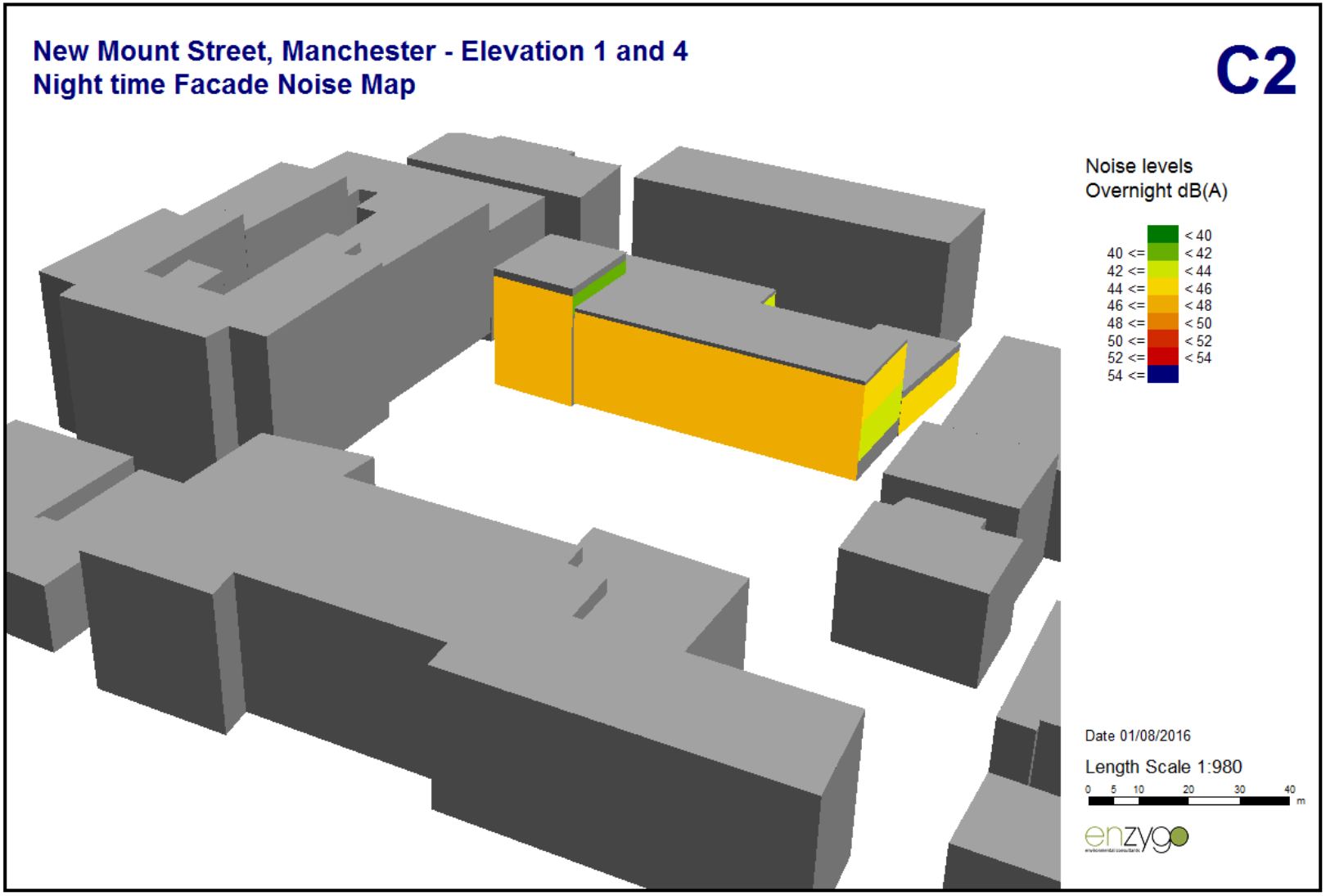


Figure C-3: 3D Façade Output – Elevation 2 & 3 Daytime

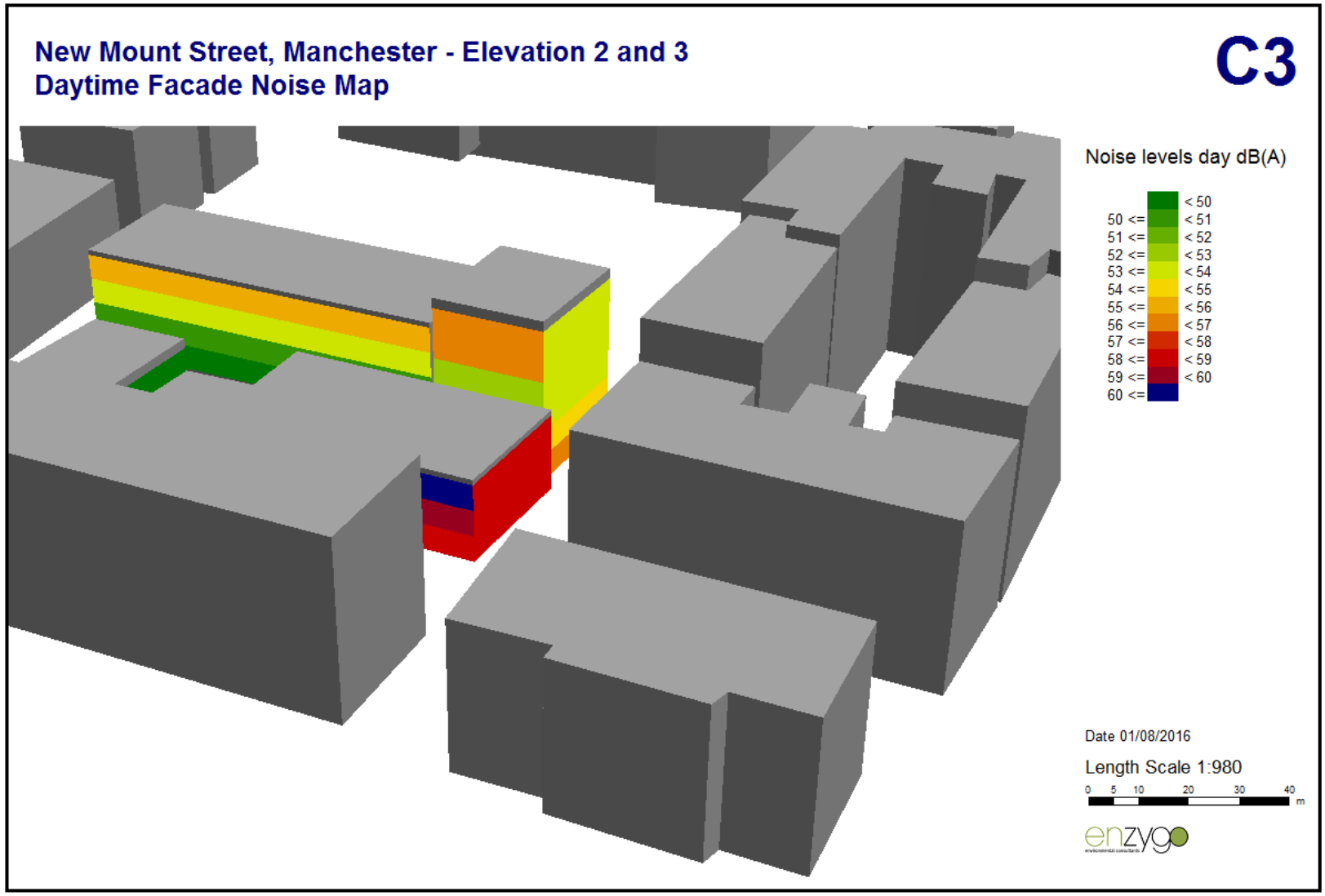


Figure C-4: 3D Façade Output – Elevation 2 & 3 Night-time

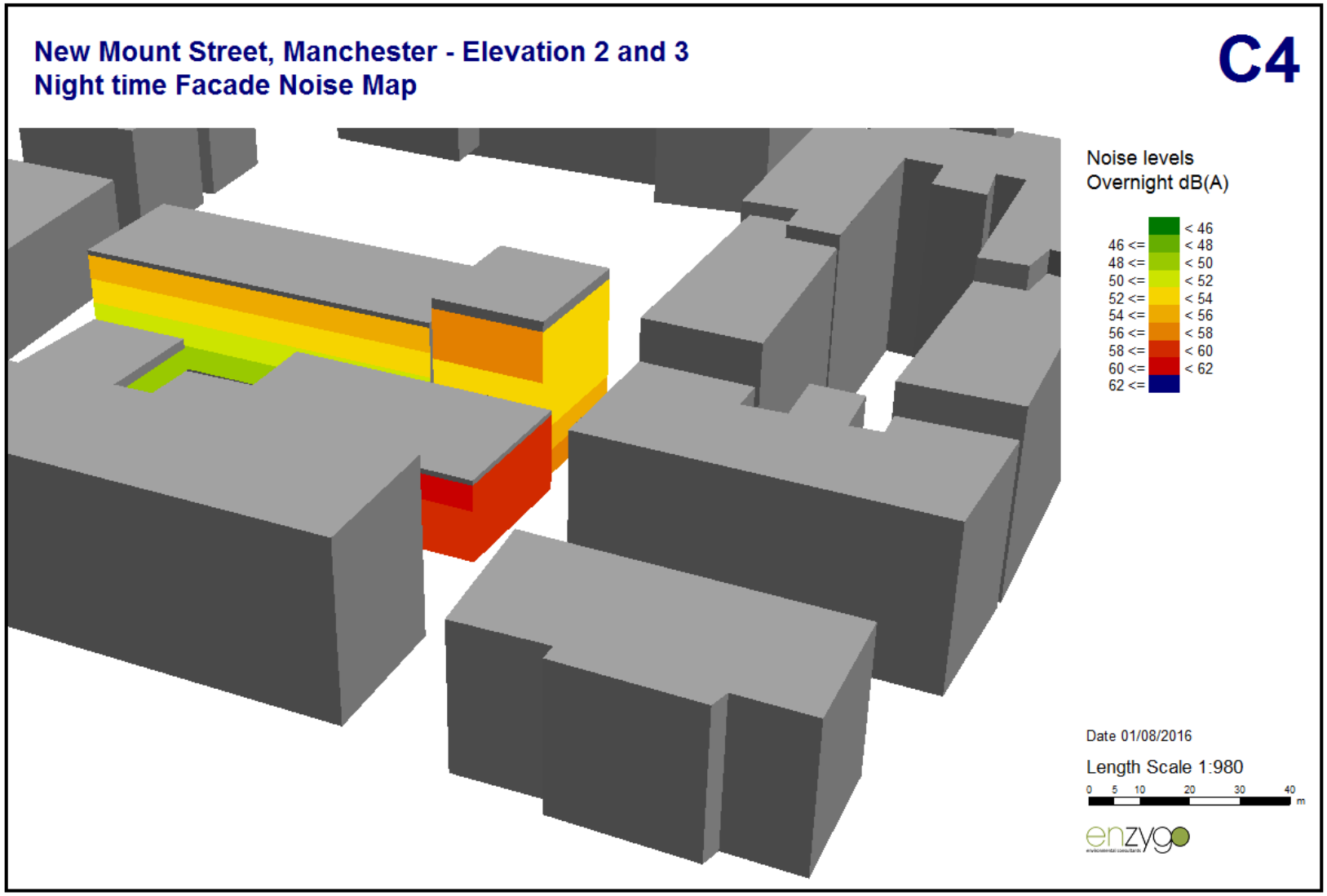


Figure C-5: 3D Façade Output – Elevation 3 & 4 Daytime

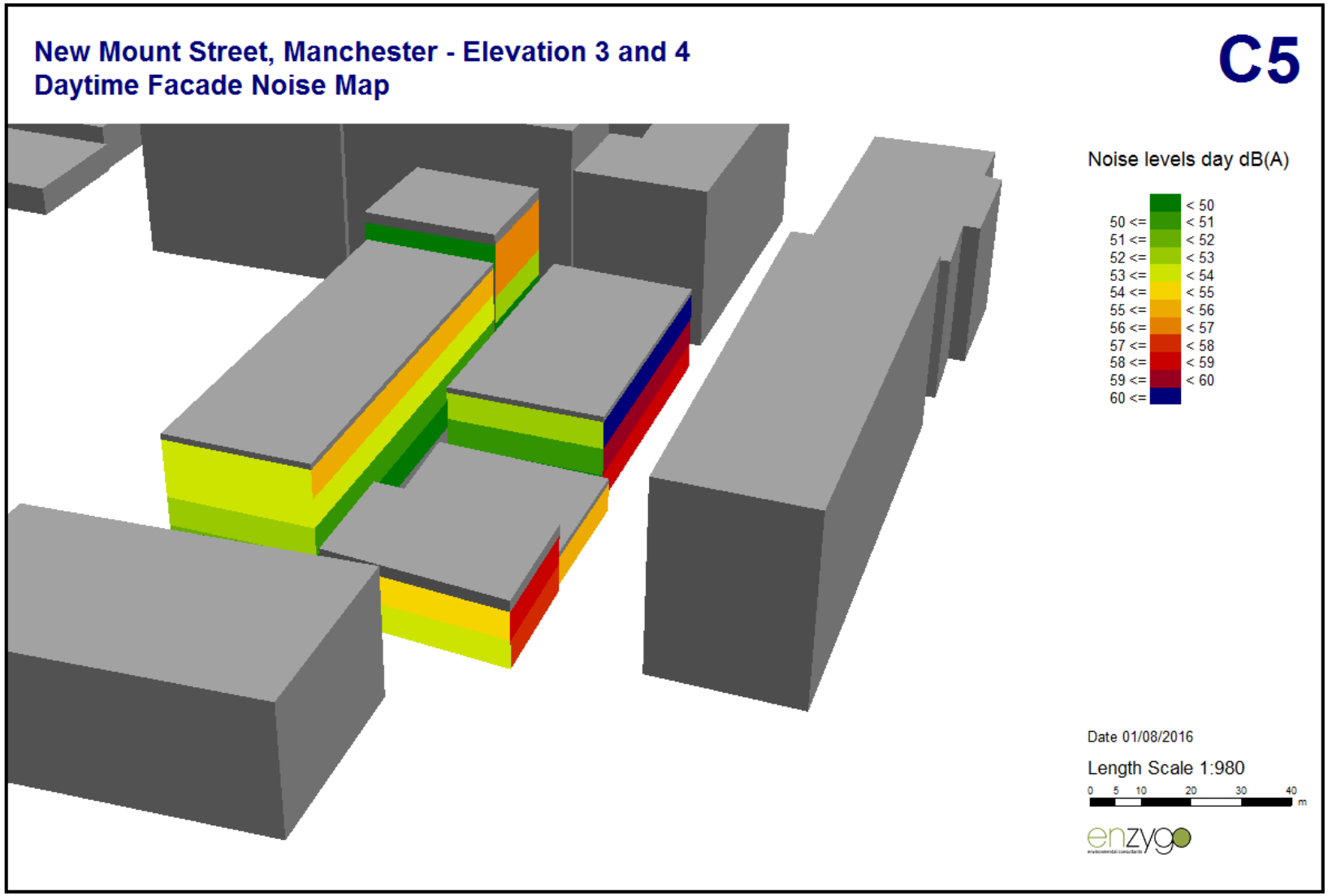


Figure C-6: 3D Façade Output – Elevation 3 & 4 Night-time

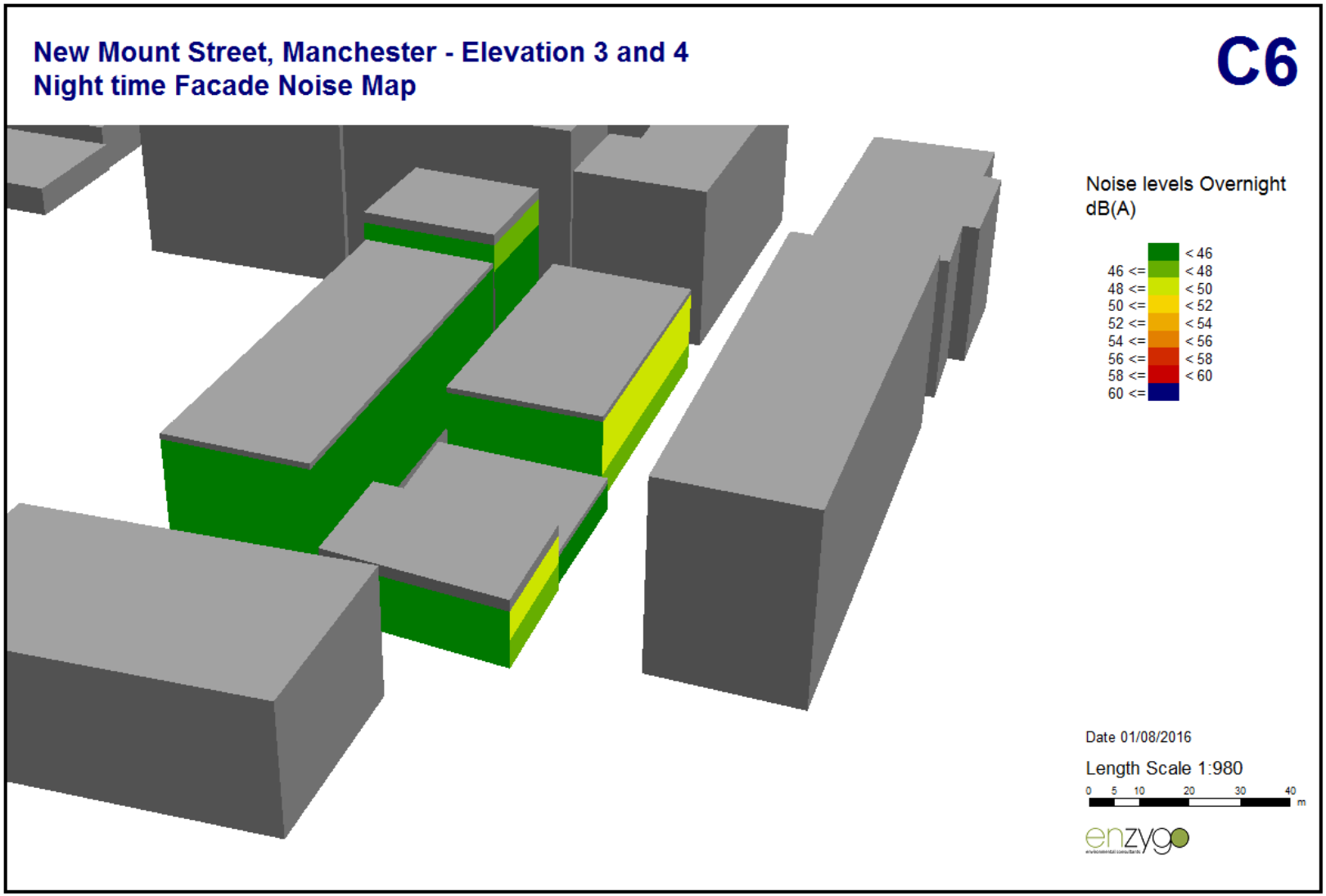


Figure C-7: Grid Noise Map – Rooftop Garden Areas

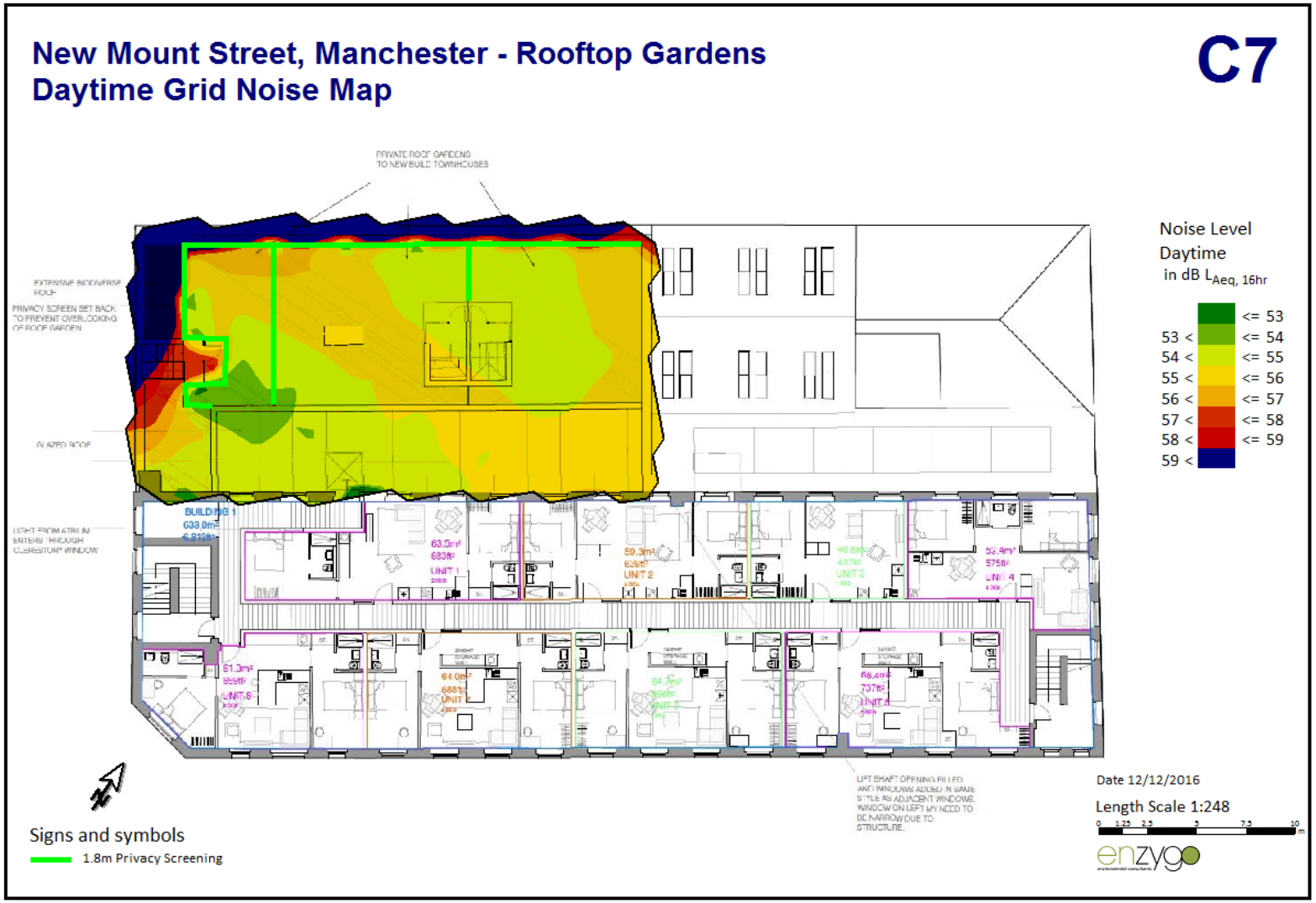


Figure C-8: Glazing Detail Sound Insulation Model

Sound Insulation Prediction (v8.0.9)

Program copyright Marshall Day Acoustics 2015

- Key No. 2596

Margin of error is generally within Rw +/- 3 dB

Job Name:New Mount St

Job No.:

Page No.:

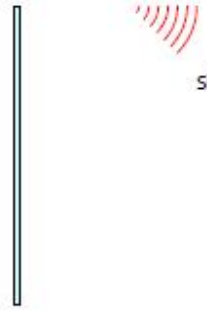
Date: 28 Jul 16

Initials:DMW

File Name: Glazing Model.ixl

Notes:

SHF.1035.004
New Mount Street
Sash Window Model



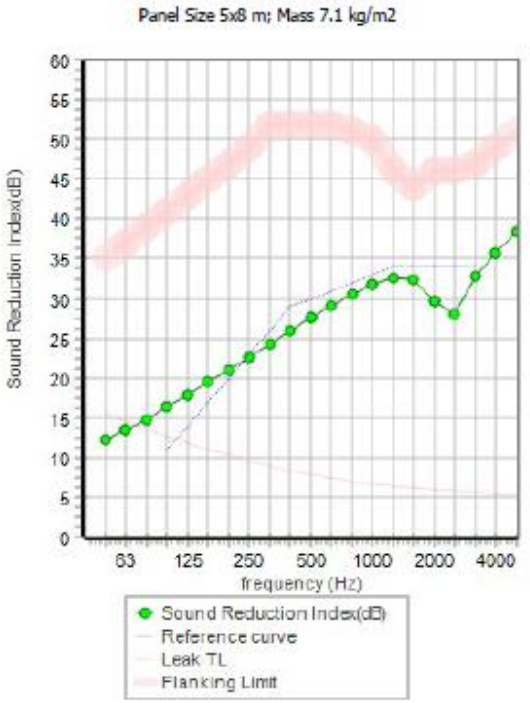
Slit leak 2 mm H x1000 mm W x6 mm D

Rw	30 dB
C	-1 dB
C_{tr}	-3 dB
D_{nTw}	26 dB [V:50m3] [A:40m2]

System description

→ 1 x 6.0 mm Glass (ρ:2430 kg/m3,E:52GPa,η:0.02)

frequency (Hz)	R(dB)	R(dB)
50	12	
63	13	13
80	15	
100	16	
125	18	18
160	19	
200	21	
250	23	23
315	24	
400	26	
500	28	27
630	29	
800	31	
1000	32	32
1250	33	
1600	32	
2000	30	30
2500	28	
3150	33	
4000	36	35
5000	38	



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