76 – 82 Oldham Street
Manchester

Acoustic Report
(Planning Conditions 8 & 9)

24535/AR1

24 May 2019

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Hann Tucker Associates

Noise Impact Assessment Report
24535/AR1

Document Control

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1	30/10/2018	Revised to include assessment of noise intrusion via MVHR systems.		
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2	24/05/2019	Addition of a section assessing commercial noise transfer from ground floor unit to residential premises above		
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This report has been prepared by Hann Tucker Associates Limited (HTA) with all reasonable skill, care and diligence in accordance with generally accepted acoustic consultancy principles and the purposes and terms agreed between HTA and our Client. Any information provided by third parties and referred to herein may not have been checked or verified by HTA unless expressly stated otherwise. This document contains confidential and commercially sensitive information and shall not be disclosed to third parties. Any third party relies upon this document at their own risk.

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25435/AR1

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1.0 Introduction

It is proposed to develop the currently vacant plots at 76-82 Oldham Street in Manchester. The proposed development will comprise 2No. residential blocks with ground floor commercial units.

Planning permission has been granted with conditions, Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and assess any potential impact on the proposed residential properties from environmental noise sources, and the potential impact to nearby noise sensitive receptors from proposed items of external fixed building services plant, in order to discharge Conditions 8 and 9 respectively.

Our survey results and assessment findings are presented herein.

2.0 Objectives

To establish, by means of manned environmental noise monitoring, the existing A-weighted (dBA) L_{90}, L_{eq} and L_{max} environmental noise levels at selected accessible positions around the site.

To undertake detailed acoustic analysis of environmental noise intrusion into the building through the external building fabric.

To subsequently prepare sound reduction performance specifications for the external building fabric in order to achieve the specified internal acoustic design criteria.

To also assess the potential noise impact the development itself will have on the locality, covering noise emissions from fixed plant and equipment.

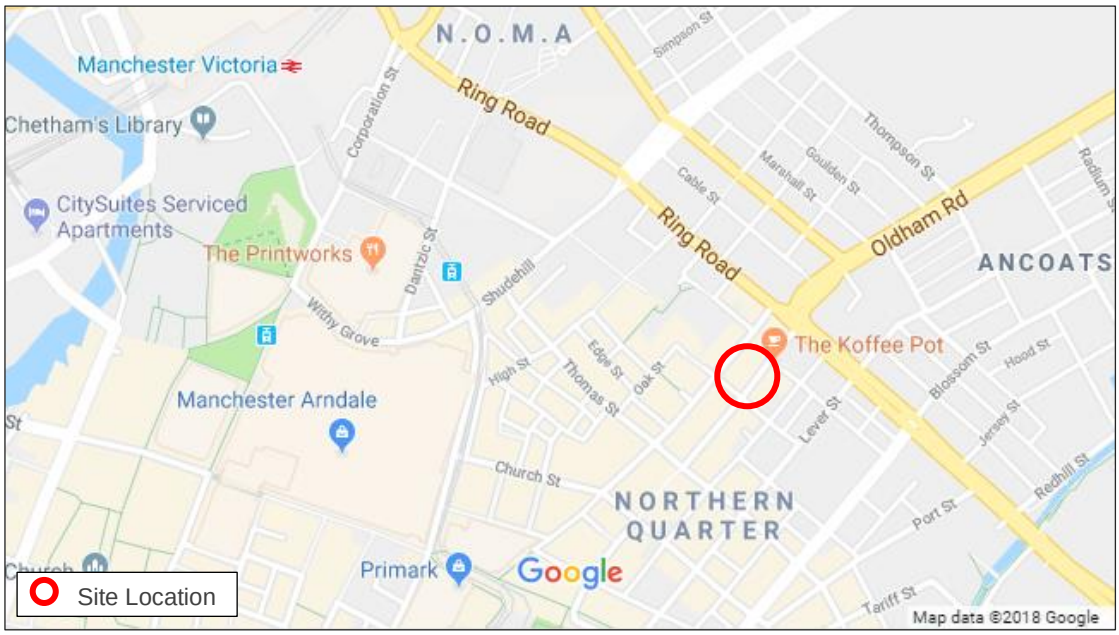
3.0 Acoustic Terminology

Please refer to Appendix A for an explanation of acoustic terminology used herein.

4.0 Site Description

3.1 Location

The site is located Oldham Street in Manchester and falls under the jurisdiction of Manchester City Council. See site location plan below.



Site Location (maps.google.co.uk)

3.2 Description

The site is positioned between Oldham Street, Warwick Street, Bradley Street, and Houldsworth Street with Spear Street separating the 2No. separate areas. The site currently comprises open land. The surrounding properties comprise mostly 2No. storey buildings with commercial on ground floor and upper floor residential and commercial properties. See site plan below.



Site Plan (maps.google.co.uk)

5.0 Planning Conditions

We understand that Manchester City Council have imposed the following planning conditions:-

"8) Before the development commences a scheme for acoustically insulating the residential accommodation against noise from Oldham Street and Spear Street; shall be submitted to and approved in writing by the City Council as local planning authority.

9) Before first occupation of the development the building, together with all externally mounted ancillary equipment, shall be acoustically insulated in accordance with a scheme submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the equipment."

6.0 Acoustic Standards & Guidelines

6.1 Noise Policy Statement for England

The Government's Noise Policy Statement for England (NPSE, March 2010) sets out the long term vision for Government noise policy, which is to "*Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development*".

The NPSE includes three primary aims to be achieved through effective management of environmental, neighbour and neighbourhood noise; (1) avoid "significant adverse" impacts on health and quality of life, (2) mitigate and minimise "adverse" impacts on health and quality of life, and (3) where possible, contribute to the improvement of health and quality of life.

6.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF, March 2012) sets out the Government's planning policies for England and how these are expected to be applied.

It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Prior to the NPPF, Planning Policy Guidelines (PPG) 24: 1994 'Planning & Noise' was the general guidance document for assessing the suitability of a site for residential use.

6.3 Planning Practice Guidance

The Department for Communities and Local Government's Planning Practice Guidance (PPG) website was launched in 2014 and provides guidance on 'Noise' for new developments in line with NPPF policies.

Notably, the website provides a table to help recognise when noise could be a concern relevant to the NOEL, LOAEL and SOAEL effect levels described in NPSE, as below:-

- Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.
- No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

There are no numeric values to reference in this guide; everything is descriptive and so cannot inform an objective assessment of noise.

6.4 ProPG: Planning & Noise

ProPG: Planning & Noise 'Professional Practice Guidance on Planning & Noise' was issued in May 2017 with the primary goal of assisting the delivery of sustainable residential development by promoting good health and well-being through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise.

It is applicable to noise from existing transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise). The recommended approach is also considered suitable where some industrial or commercial noise contributes to the acoustic environment provided that is "not dominant".

ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

The ProPG considers suitable guidance on internal noise levels found in BS8233:2014 'Guidance on sound insulation and noise reduction for buildings' with the addition of an "ideal" $L_{Amax,f}$ requirement for bedrooms at night.

6.5 Local Planning Requirements

Manchester City Council requirements are outlined in Section 3.0 of Manchester City Council's Planning & Noise Technical Guidance document (December 2015).

Achieving Suitable Internal Noise Levels

Section 3.6.1.1 sets out the following noise levels to be achieved for residential developments:

- *Bedrooms (Night time - 23:00 to 07:00): 30dB L_{Aeq} and individual noise events should not normally exceed 45 dB (L_{Amax}).*
- *Living Rooms (Day time 07:00 to 23:00): 35 dB (L_{Aeq}).*
- *Gardens and terraces (daytime) 55 dB (L_{Aeq}).*

Section 5.3.1.3.1.2 of the Planning & Noise – Technical Guidance December 2015 document states the following with regards to maintaining internal ambient noise levels when it desired to keep windows closed but provide adequate ventilation:

"Occupants should be provided with a supply of fresh air in habitable rooms without having to open windows (whilst also having the option to do this for purge ventilation, or at the occupant's discretion.

Where ambient noise levels are high a scheme of ventilation will need to be provided that does not compromise the acoustic attenuation afforded by glazing. This may come in the form of individual window trickle vents or acoustic trickle vents."

Plant Noise

Section 3.6.1.5.1 outlines that the noise assessment for fixed plant should be based on BS 4142:2014 and the assessment must demonstrate that

"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location."

6.6 BS 8233: 2014

British Standard 8233:2014 "Sound insulation and noise reduction for buildings" recommends design criteria for internal ambient noise levels for dwellings providing a reasonable or good level of protection from external noise. It states that it is desirable that internal ambient noise levels do not exceed the following guidelines:

Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 – 07:00
Resting	Living Rooms	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

The document goes on to state that all of the above target levels may be relaxed by 5 dB and "reasonable" internal conditions would still be achieved.

For outdoor living spaces, a desirable upper guideline value of 55dB $L_{Aeq,\,T}$ is quoted.

6.7 BS 4142: 2014

BS 4142: 2014 describes methods for rating and assessing the effects of outdoor sound levels, of an industrial and/or a commercial nature, "*on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*".

The impact of a specific sound is indicated by subtracting the existing background noise level from the rating level (i.e. noise level from the proposed items of plant/machinery/etc plus any acoustic feature corrections).

The standard states that:

- *"a difference of around +10dB or more is likely to be an indication of a significant adverse impact"*;
- *"a difference of around +5dB is of marginal significance is likely to be an indication of an adverse impact"*;
- *"where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact"*.

The noise from the new development is expressed in terms of a rating level and given as a $L_{Aeq,\,T}$ noise level. The existing background noise level is expressed in terms of a $L_{A90,\,T}$ noise level. T is the assessment time interval, which is 1-hour for operations during daytime hours (07:00 to 23:00 hr) and 15-minutes for operations during night-time hours (23:00 to 07:00 hr).

BS 4142:2014 states that if a noise source contains an 'acoustic feature', such as tonality, intermittency or impulsiveness, an appropriate penalty should be applied.

7.0 Baseline Noise Survey

7.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 11:00 hours on Thursday 3 May to 11:00 hours on Friday 4 May 2018 in order to establish continuous noise readings over a 24 hour period. Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{Fmax} sound pressure levels over 15 minute periods. Supplementary continuous automated measurements were made over shorter periods in order to verify night-time L_{Fmax} events.

Measurements were undertaken in accordance with BS 7445-1:2003 Description and Measurement of Environmental Noise.

7.2 Weather Conditions

Due to the nature of the survey, i.e. automated, it is not possible to comment accurately on the weather conditions throughout the survey period. However during the period we were on site, weather conditions were considered suitable for obtaining representative measurement results. Wind conditions were calm and the sky was generally clear.

7.3 Measurement Positions

The noise level measurements were undertaken at two (2No.) positions around the development site, as described/illustrated below.

Position	Description
1	At the southwest corner of the site, overlooking the corner of Oldham Street and Warwick Street. At an approximate height of 2.2m in free-field conditions.
2	At the northeast corner of the site, overlooking the corner of Spear Street and Houldsworth Street. At an approximate height of 2.2m in free-field conditions.

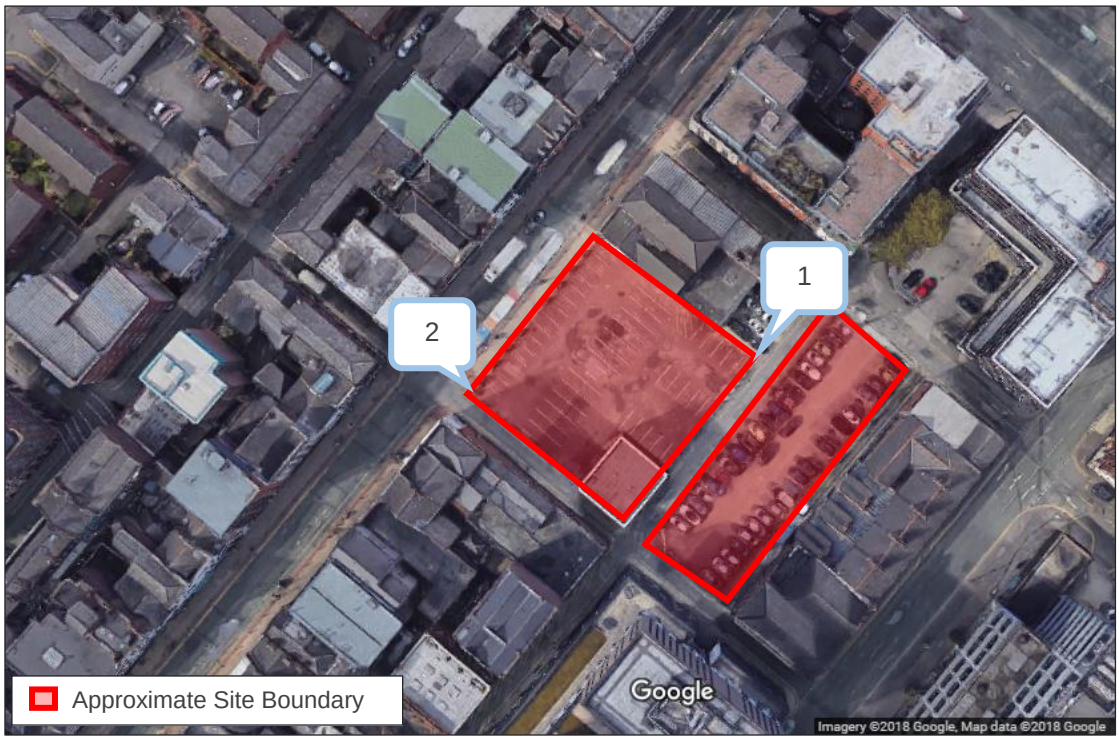


Image Showing Measurement Positions (maps.google.com)

7.4 Instrumentation

The instrumentation used during the survey is presented in the Table below.

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Sound Level Meter *(Position 1)*	Larson Davis	824	3533	30/08/2017
Type 1 Sound Level Meter *(Position 2)*	Larson Davis	824	3824	30/08/2017
Type 1 Calibrator	Larson Davis	CAL200	3083	13/04/2017

Each microphone was mounted on a pole with the microphone fitted with a windshield. All equipment was calibrated prior to and on completion of the survey. No significant deviations occurred (no more than 0.1 dB).

7.5 Results

The results of the automated survey have been plotted on Time History Graphs 24535/TH1 to 24535/TH2 enclosed. These graphs present the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each position throughout the duration of the survey.

A summary of the results from the environmental noise survey are presented in the table below. These values represent the free-field incident noise levels that will inform our subsequent assessments.

Position	Daytime (07:00 – 23:00 hrs)		Night-time (23:00 – 07:00 hrs)		
	$L_{Aeq,16h}$	Typical Lowest $L_{A90,15min}$	$L_{Aeq,8h}$	Typical Lowest $L_{A90,15min}$	10th Highest $L_{Amax,15min}$*
1	58	48	53	41	74
2	64	52	60	43	80

* shortened measurement periods showed < 1dB change in 10th highest L_{Fmax} per interval

7.6 Discussion of Noise Climate

Due to the nature of the automated survey, i.e. unmanned, it is not possible to accurately describe the dominant noise sources, or specific noise events throughout the entire survey period. However at the beginning and end of the survey period the dominant noise source was noted to be road traffic noise from Oldham Street and the surrounding road network.

8.0 Noise Levels within Apartments (Condition 8)

8.1 Overview

This section aims to assess the impact of the prevailing noise sources on the residential development in order to determine the acoustic performance specifications for critical residential façade elements (namely glazing and ventilators).

Our calculations are based on BS 8233:2014 procedures and consider typical apartment bedroom/living room dimensions and window sizes.

We understand that background ventilation will be provided via whole-apartment MVHR with openable windows for purge ventilation conditions.

8.2 Incident Noise Levels

In order to accurately determine the spread of environmental noise levels across the site, we have constructed a computer-based 3-dimensional model of the development. The software produces a ‘noise map’ of the site using ISO 9613 sound dissipation principles (including distance loss, screening, ground absorption, etc.) and is calibrated based on the results of our baseline environmental noise survey. All buildings have a reflection loss of 0dB (i.e. fully reflective).

Appendix C comprises noise maps showing the predicted incident daytime (16-hr) and night-time (8-hr) L_{Aeq} external free-field environmental noise levels on all facades.

8.3 Achieving Internal Noise Levels

8.3.1 Overview

This section presents our minimum specifications for the external building fabric in order to suitably control incident environmental noise levels based on the above noise survey results.

8.3.2 Façade Performance Specifications

The following plan illustrates the different façade zones of the proposed development.



Plan Showing Façade Performance Zones – Level 01-02



Plan Showing Facade Performance Zones – Level 03



Plan Showing Façade Performance Zones - Level 04-05



Plan Showing Façade Performance Zones Level - 06-07

The complete façade specification for the above zones are presented in the following table.

Zone	Room Type	Min. Façade Sound Reduction Performance $R_w + C_{tr}$
Green	Living Room	**26 dB**
	Bedroom	**30 dB**
Orange	Living Room	**26 dB**
	Bedroom	**34 dB**
Red	Living Room	**31 dB**
	Bedroom	**37 dB**

The external wall and glazing/ventilator specifications for each zone are detailed in Sections 8.3.3 and 8.3.4 below.

8.3.3 External Walls

We understand the current external wall construction to comprise the following:-

- 20mm Brick Slip;
- 150mm (min.) cavity with 150mm Rockwool;
- 9mm Sheathing Board;
- 100mm (min.) SFS stud with 100mm Rockwool;
- 2 x 15mm dense plasterboard (min 12.5 kg/m^2 each).

We would expect the above construction to achieve circa 49 dB R_w+C_{tr}, and is therefore capable of meeting the above façade specification in all zones.

8.3.4 Glazing

Based on the complete façade specification in Section 8.3.2, the above estimated external wall sound reduction values and window and room dimensions provided by Wright Investments, the following table presents the minimum sound reduction performance specifications for glazing systems tested in accordance with BS EN ISO 10140-2:2010.

Zone	Room Type	Min. Glazing Sound Reduction Performance $R_w + C_{tr}$
Green	Living Room	**27 dB**
	Bedroom	**27 dB**
Orange	Living Room	**27 dB**
	Bedroom	**31 dB**
Red	Living Room	**31 dB**
	Bedroom	**35 dB**

It is essential that the prospective system suppliers can demonstrate compliance with the acoustic performance specification above rather than simply offering a generic glazing configuration. However, we would suggest that the following configuration could typically be expected to provide the required levels of noise insulation.

Required R_w+C_{tr}	Example Configuration
27 dB	6 / 16 / 6mm double glazing
31 dB	10 / 16 / 6mm double glazing
35 dB	10 / 16 / 6.4mm laminated double glazing

It is essential that the entire system is tested and that the quoted performance figures are met by the system as a whole (not just the glass).

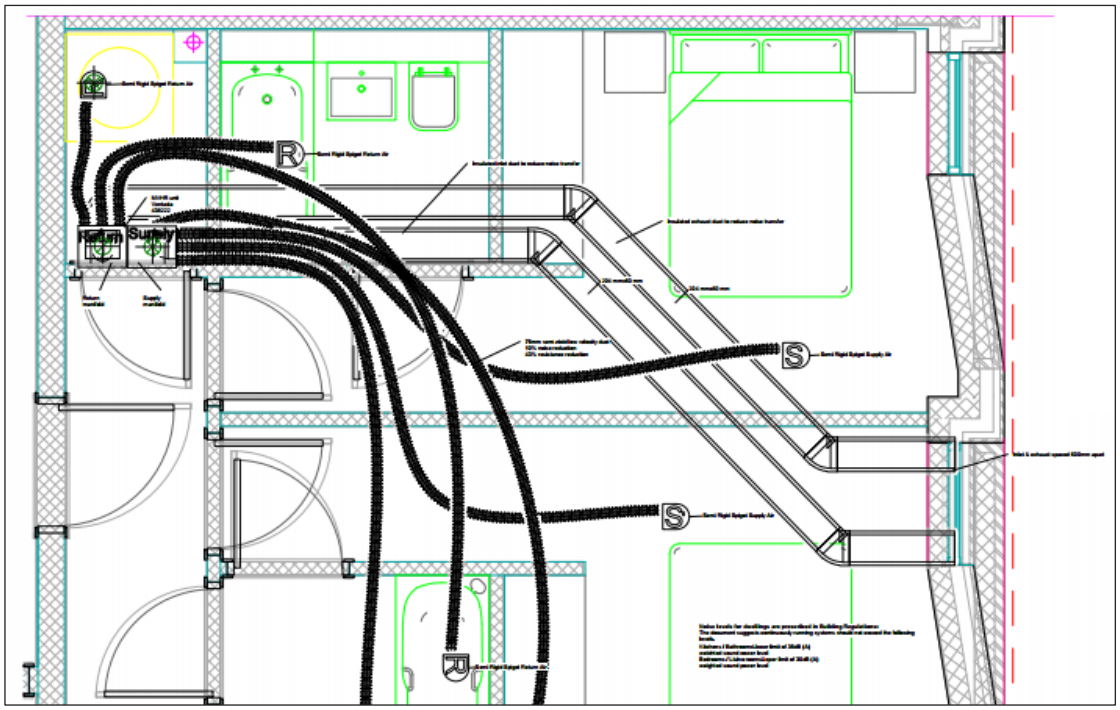
For all areas, where structural glass or non-vision spandrel panels are proposed they should provide sound reduction performance at least equal to that required of the façade specification presented in Section 8.3.2 above in order to maintain the acoustic integrity of the building envelope.

8.3.5 Ventilation

The above presents a solution to satisfy the proposed internal ambient noise limits within apartments during normal ventilation conditions where windows are closed and background ventilation is provided via the whole-apartment MVHR.

During purge ventilation conditions (e.g. fume extract and summer-time cooling), windows will be openable and there is the potential for internal ambient noise levels to exceed the BS 8233 targets.

We have undertaken a review of the predicted internal noise levels within the worst case apartments based upon the ventilation proposals and typical MVHR layouts as detailed on the drawing 'Typical Residential MVHR Layout' (ref PNR18-WRI-BB-R-DR-ME-(749)04) provided by Wright Investments.



Typical Residential MVHR Layout (c/o Wright Investments)

From the above drawing we understand the following critical parameters which form the basis of our assessment:-

- 204x60mm duct face dimension;
- 2No. duct branches will run through habitable rooms;
- The maximum length of ductwork running through the ceiling void of any habitable room is approximately 2m;
- Each duct will terminate on the atmospheric side via a 204x60mm letterbox opening in the façade, i.e. not via plenum.

Based on the above parameters, we have predicted the resultant internal noise levels in the worst affected bedrooms along Oldham Street (highest incident noise levels) from atmospheric noise intrusion via MVHR ductwork breakout. The below table summarises our assessment.

Description	Index at Octave Band Centre Frequency (dB)							dBA
	63	125	250	500	1k	2k	4k	
Worst case incident $L_{Aeq,8hr}$	60	62	58	56	56	53	47	60
Resultant Sound Power, L_w, entering duct (204x60mm)	47	43	39	37	37	34	28	-
Breakout Sound Pressure, L_p, radiating from ductwork	42	35	28	23	20	14	5	-
Correction for 2No. ducts	+3	+3	+3	+3	+3	+3	+3	-
Ceiling loss (single layer plasterboard)	-4	-7	-12	-15	-20	-24	-26	-
Resultant internal $L_{Aeq,8hr}$ from duct breakout	**41**	**31**	**19**	**11**	**3**	**0**	**0**	**19**

Description	Index at Octave Band Centre Frequency (dB)							dBA
	63	125	250	500	1k	2k	4k	
10th Highest incident L_{Amax}	83	80	77	75	71	75	74	80
Resultant Sound Power, L_w, entering duct (204x60mm)	64	61	57	56	51	55	55	-
Breakout Sound Pressure, L_p, radiating from ductwork	59	53	47	42	34	35	32	-
Correction for 2No. ducts	+3	+3	+3	+3	+3	+3	+3	-
Ceiling loss (single layer plasterboard)	-4	-7	-12	-15	-20	-24	-26	-
Resultant internal L_{Amax} from duct breakout	**58**	**49**	**38**	**30**	**17**	**14**	**10**	**37**

From the above summary it can be seen that for the worst case assessment (highest incident noise levels during most onerous conditions, night-time) of environmental noise intrusion via typical MVHR ductwork, the resultant internal noise levels from ductwork breakout are expected to be 8-10dB less than the internal ambient and maximum noise targets (30/45 dBA for

bedrooms at night) and is therefore expected to be effectively inaudible in the presence of noise break-in via the façade, which is design to achieve the aforementioned internal ambient and maximum noise targets of 30 and 45 dBA respectively.

Furthermore, as it is demonstrated that environmental noise intrusion via the proposed MVHR ductwork should not be an issue in the worst affected bedrooms, it can be reasonably assumed that no specific mitigation should be required in any zone of the development in order to mitigate environmental noise intrusion via MVHR ductwork.

9.0 Commercial Transfer Noise Assessment

As commercial units are proposed on the ground floor of the development and could be used for A1, A2 and A3 uses, noise transfer between the ground floor and the residential premises above needs to be assessed.

In the absence of specific Local Authority criteria for commercial noise transfer to habitable rooms it is recommended that in order to prevent loss of amenity to the habitable rooms directly above the aim should be approximately 10 dB below the standard BS 8233:2014 internal ambient noise level criteria.

Based on the above, and with consideration to the need for spectral noise control in octave bands between 63 Hz and 4 kHz, we would propose that reverberant noise levels from the commercial units should be controlled to not exceed NR 15, with a relaxation to 41 dB at 125 Hz in line with the research contained within NANR45 *'Procedure for assessing low frequency noise complaints'*, within the habitable rooms directly above the commercial unit.

We understand the building to be constructed from a concrete frame with floor slabs to comprise a minimum of 300 mm reinforced concrete. For the purposes of our commercial noise transfer assessments, we would typically expect the following sound reduction performance from a 300 mm reinforced concrete slab.

Description	Sound Reduction Index (*R* dB) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
300 mm concrete	45	44	51	58	64	68	73

Based on the above sound insulation performance the maximum operational noise levels have been calculated within the commercial units on the ground floor. These are presented below.

Maximum Operational Noise Level (dB) at Octave Band Centre Frequency (Hz)							A-weighted sound pressure level (dBA)
63	125	250	500	1k	2k	4k	
90	86	78	78	81	82	85	90

The above noise limits are suitable for A1, A2 and A3 use with low level ambient music and will not affect the usability of the ground floor units for these uses. If any future tenant wishes to produce higher noise levels than given above, an assessment of noise transfer will need to be carried out and mitigation measures (ie a sound insulating ceiling) will need to be installed.

The control of noise output from the proposed commercial unit should be secured with suitable wording and detailed acoustic noise limits set within tenant's handbook and the Local Planning Authority may also wish to secure this with a condition of planning.

10.0 Assessment of Noise Levels in Outdoor Living Spaces

On this scheme, we understand outdoor living spaces will be apartment roof terraces. Small balconies are not generally considered as 'outdoor living' due to their size. In this regard, BS 8233 states:-

"Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation… Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

Using the detailed 3D noise model described in Section 8.2 of this report we have predicted the $L_{Aeq,16hr}$ noise levels across a range of receivers within the proposed rooftop terrace areas.

The locations of the proposed terraces and modelled receivers are described in the plan and table below:-



Plan Showing Modelled Receptor Locations in Rooftop Terrace Areas

Terrace	Receiver Position	Predicted Daytime $L_{Aeq,16hr}$ at 1.5m Above Roof Level	BS 8233 "Ideal" Target $L_{Aeq,16hr}$	Compliance
A	1	63 dB	55 dB	✗
	2	56 dB	55 dB	✓
	3	51 dB	55 dB	✓
B	1	57 dB	55 dB	✓
	2	46 dB	55 dB	✓
	3	43 dB	55 dB	✓
C	1	57 dB	55 dB	✓
	2	54 dB	55 dB	✓
	3	49 dB	55 dB	✓
	4	57 dB	55 dB	✓

Our calculations indicate noise levels can be expected to achieve the desired 55 dB $L_{Aeq,16hr}$ across the majority of the outdoor living spaces.

11.0 Plant Noise (Condition 9)

11.1 Plant Noise Emission Limits

Based on the results of our noise survey and the requirements of the LPA, we propose the following incident plant noise emission limits to be achieved at 1m from all nearby noise sensitive windows in the vicinity of the east and west of the site respectively, including the residential windows of the proposed dwellings.

Period	Cumulative Plant Noise Emission Limit (BS 4142:2014 Rating Level)	
	East	West
Daytime / Evening (07:00-23:00)	43 dBA	47 dBA
Night-time (23:00-07:00)	36 dBA	38 dBA

Noise shall be assessed in accordance with BS 4142:2014 with corrections applied for any plant emitting noise of a tonal or irregular quality. Emergency plant items (e.g. standby generators, smoke extract equipment) should be subject to more relaxed criteria.

The above limits shall be subject to the final approval of Manchester City Council.

11.2 Plant Noise Mitigation Measures

Due to the nature of the development, the only significant plant items are likely to be those serving the commercial units (air extraction and air conditioning units).

Where Landlord plant is required, provisions shall be made for the selection of low noise equipment, silencers, enclosures, screens, and other acoustic attenuation measures where necessary. At this stage it is envisaged that the risk of excessive building services noise can be mitigated by design.

Hann Tucker Associated will review Landlord plant once selections have been finalised. It may be appropriate to ensure that Landlord plant selections are made to achieve 3 dB below the above limits in order to leave sufficient headroom for tenant plant.

Once Landlord plant has been reviewed, limits should be stipulated within the Agreement for Lease as to ensure that any items of tenant plant do not give rise to an exceedance of the above criteria.

12.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the prevailing environmental noise climate at the development site.

The acoustic requirements of national/local policies, current industry guidelines and other relevant documentation have been reviewed and used to inform a detailed noise impact assessment of incident environmental noise affecting the development as well as potential noise output from the development in order to discharge Planning Conditions 8 and 9 respectively.

Specifications for the different façade zones, external walls, and glazing required in order to meet the internal noise criteria have been provided.

A review of typical MVHR layouts has been undertaken in order to determine the resultant internal noise levels due to external noise intrusion via MVHR ductwork.

An assessment of commercial noise intrusion from the ground floor retail unit to the residential dwelling above has been carried out and operational noise limits have been set in-line with proposed criteria.

In lieu of specific plant selections plant noise emission limits have been proposed and consideration has been given to the need for accommodation of both landlord and tenant plant items.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Appendix B

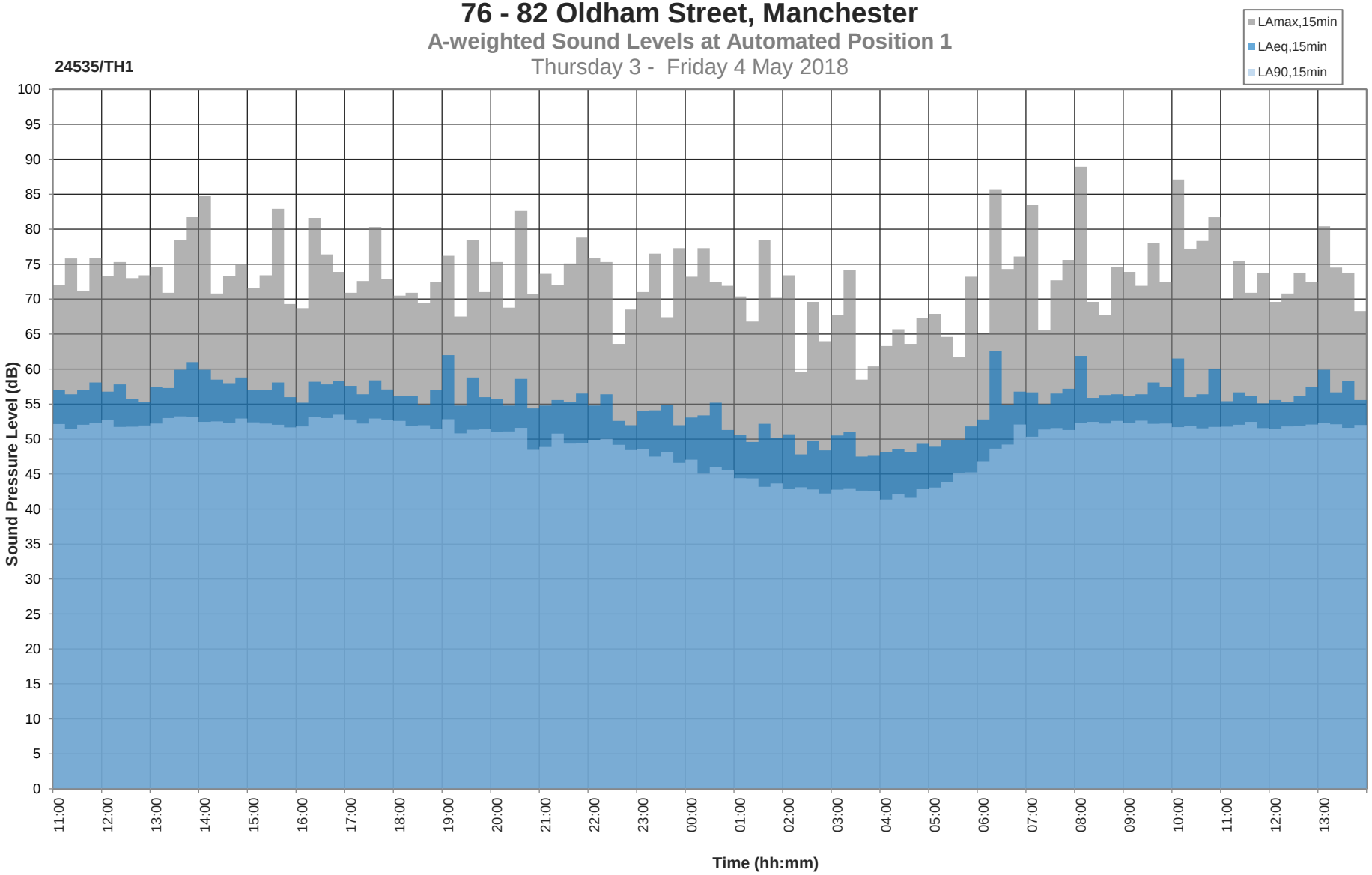
Time History Graphs 25405/TH1-2

76 - 82 Oldham Street, Manchester

A-weighted Sound Levels at Automated Position 1

Thursday 3 - Friday 4 May 2018

24535/TH1

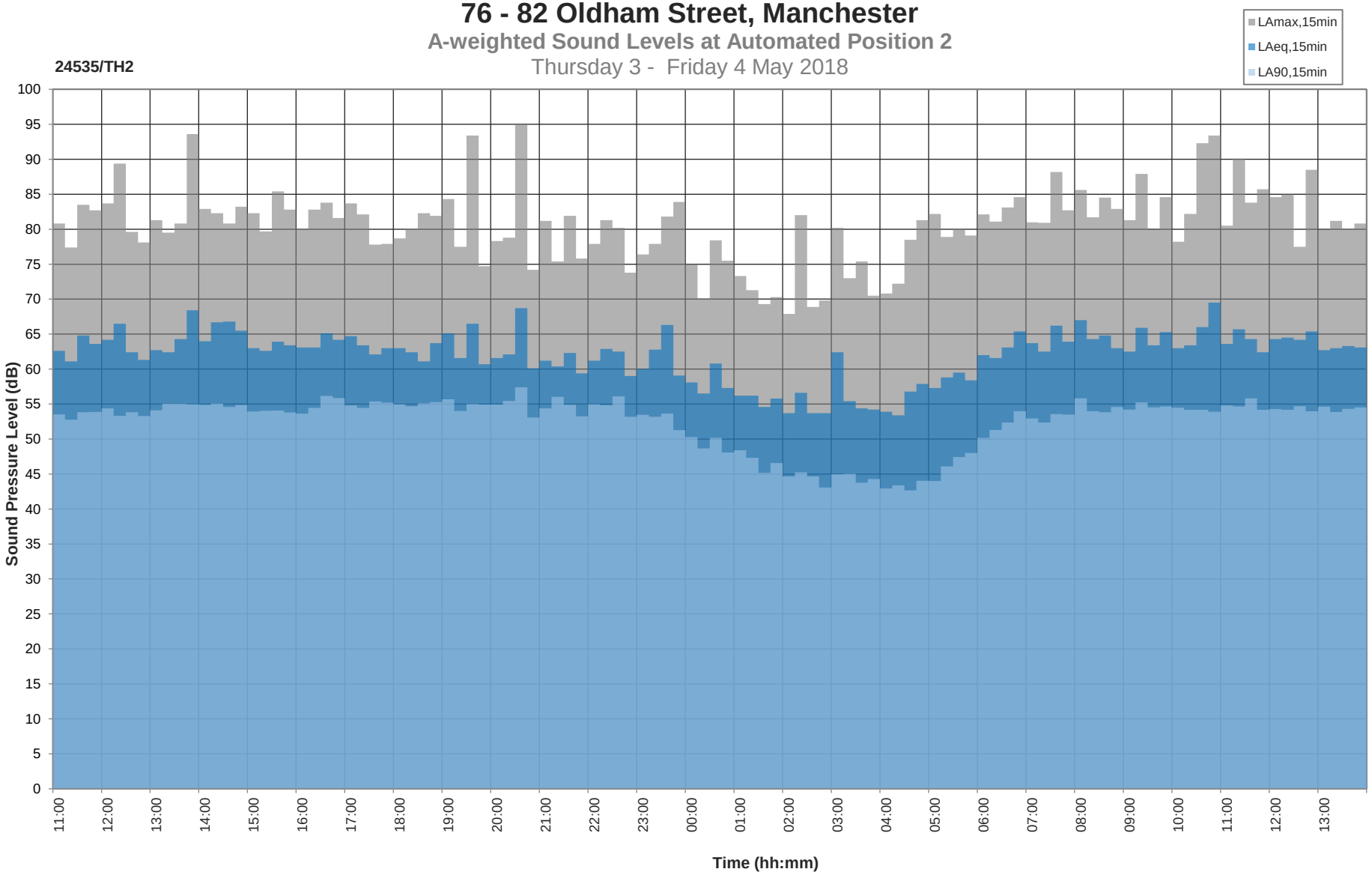


76 - 82 Oldham Street, Manchester

A-weighted Sound Levels at Automated Position 2

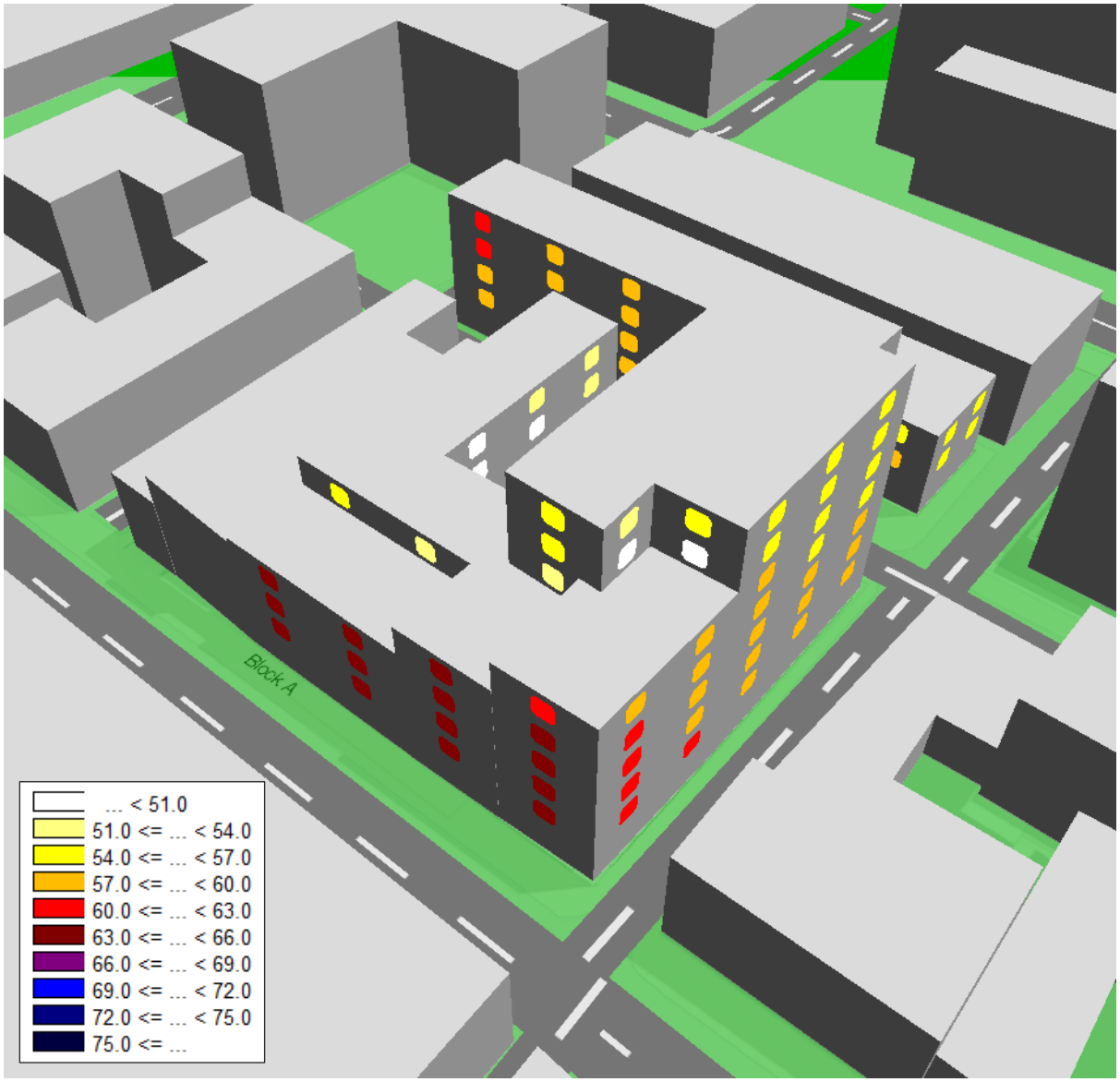
Thursday 3 - Friday 4 May 2018

24535/TH2

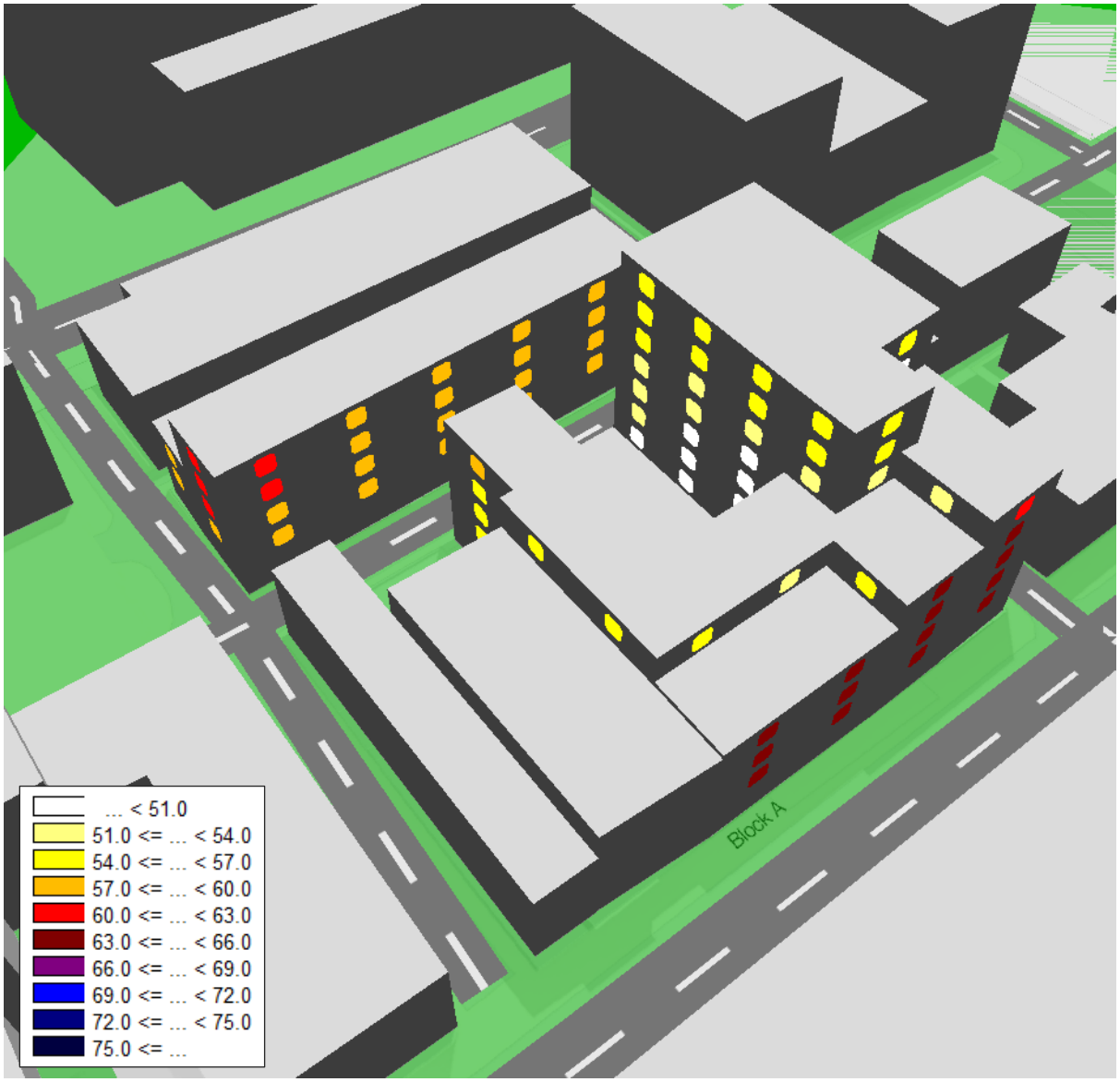


Appendix C

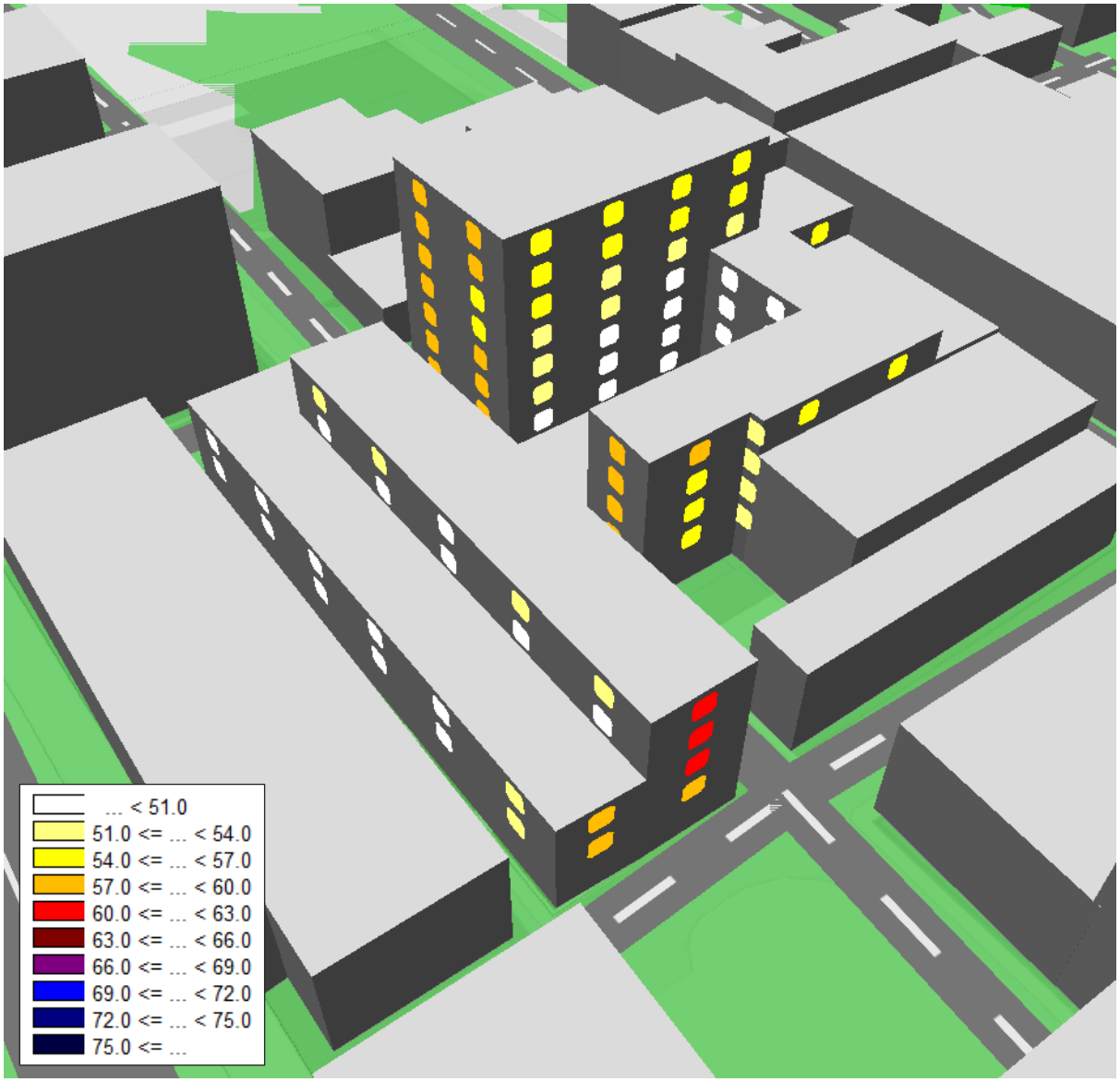
3D Noise Maps



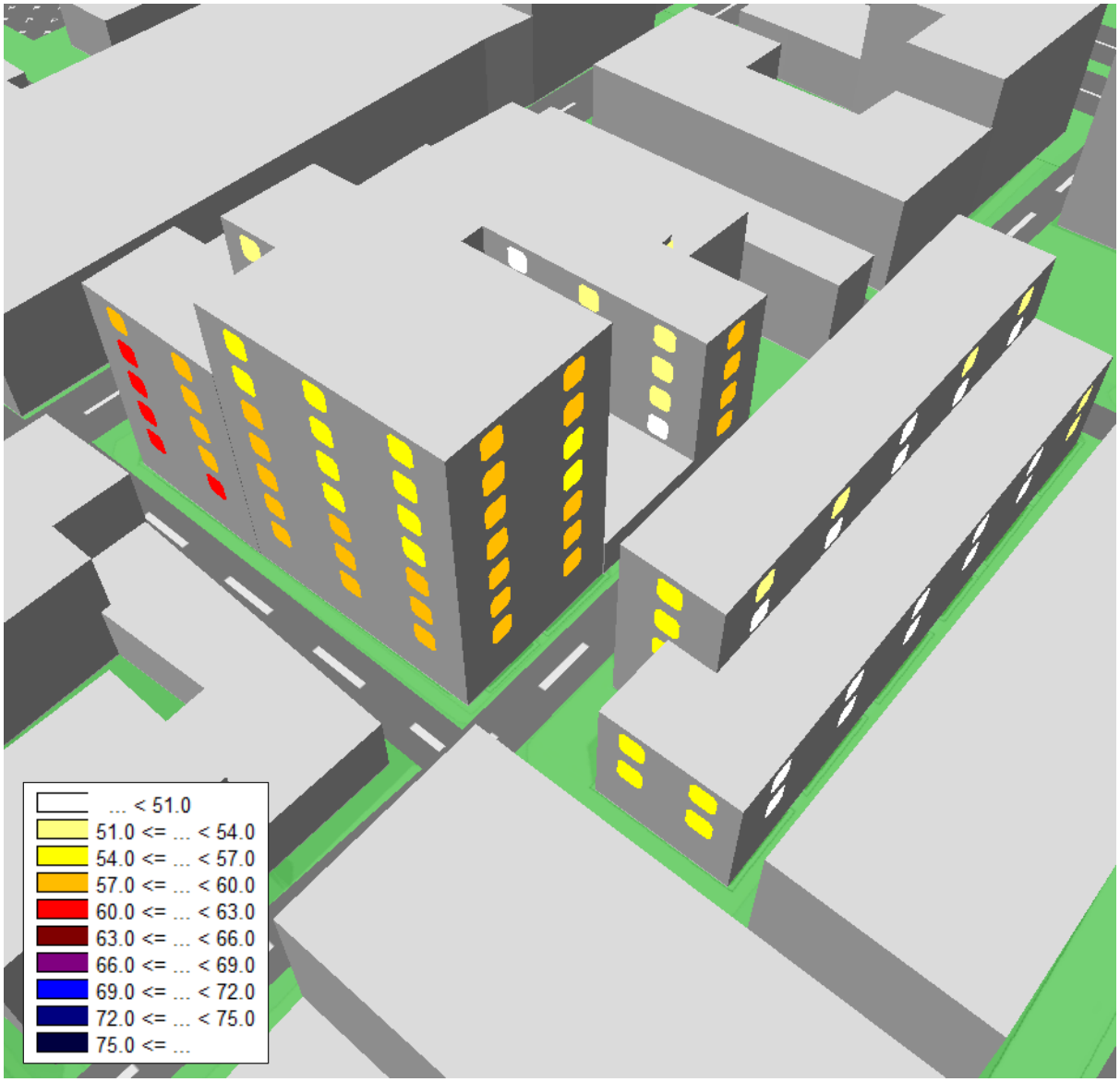
Daytime Incident $L_{Aeq,16hr}$ Noise Levels (from west)



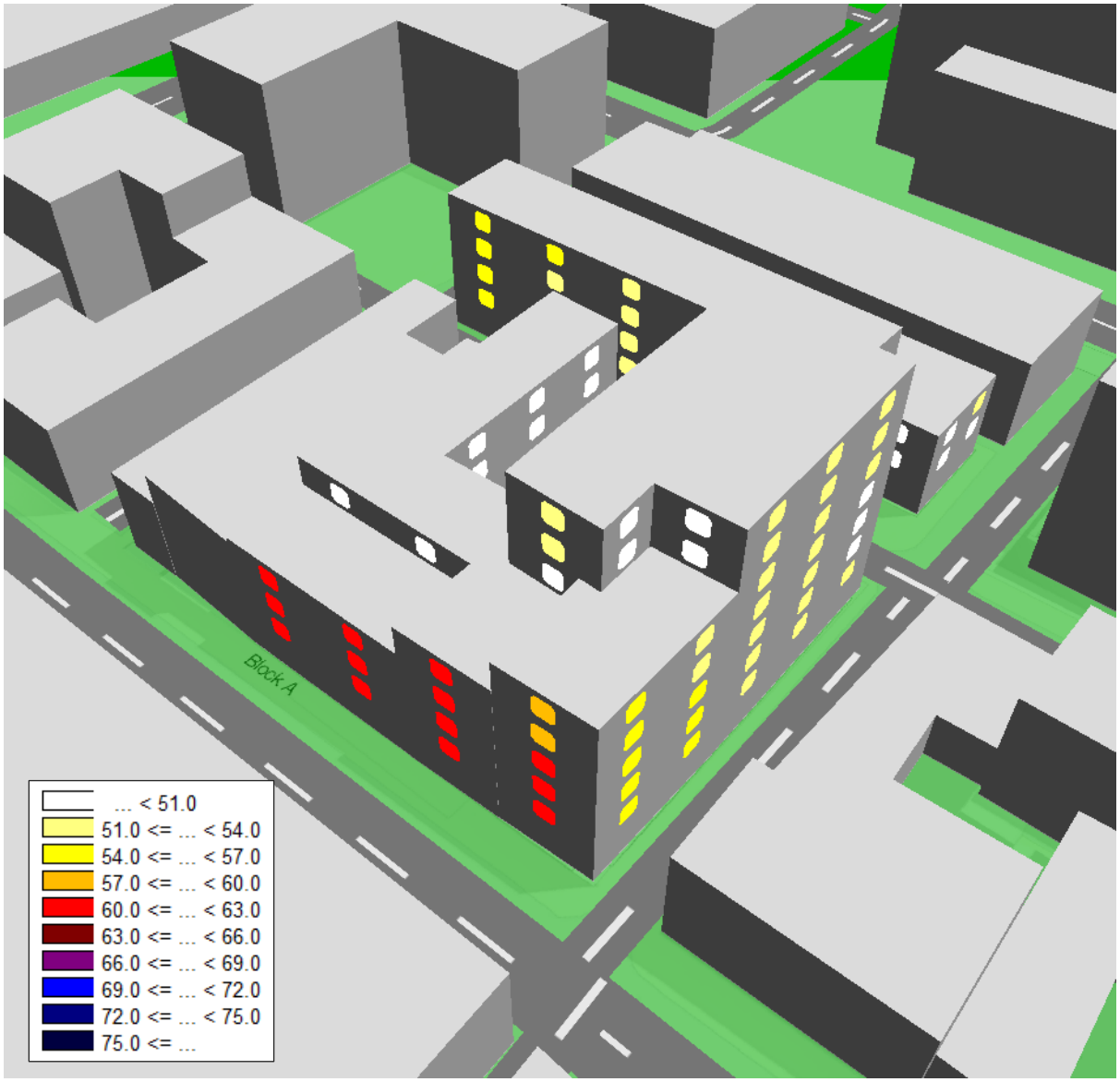
Daytime Incident $L_{Aeq,16hr}$ Noise Levels (from north)



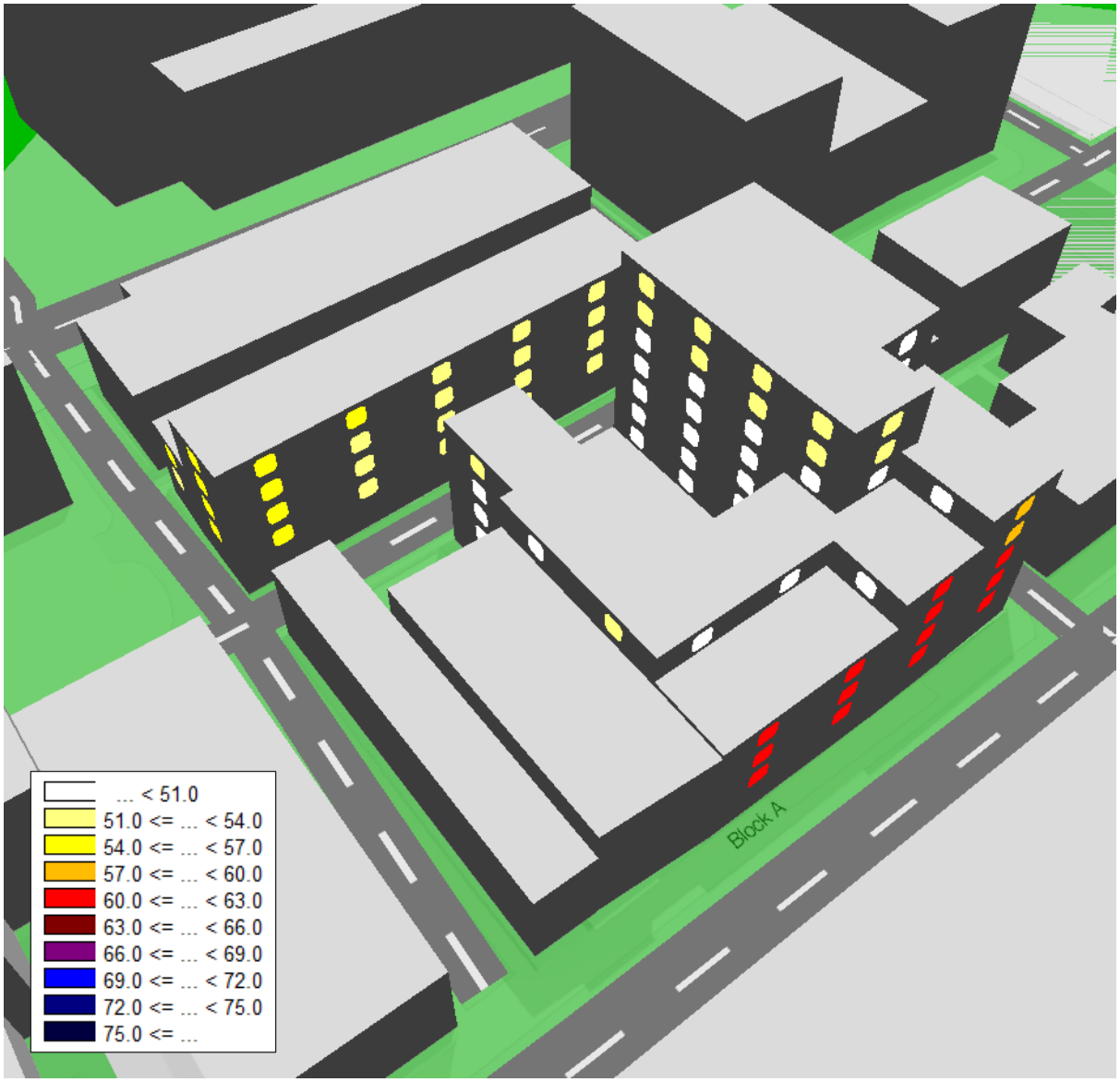
Daytime Incident $L_{Aeq,16hr}$ Noise Levels (from east)



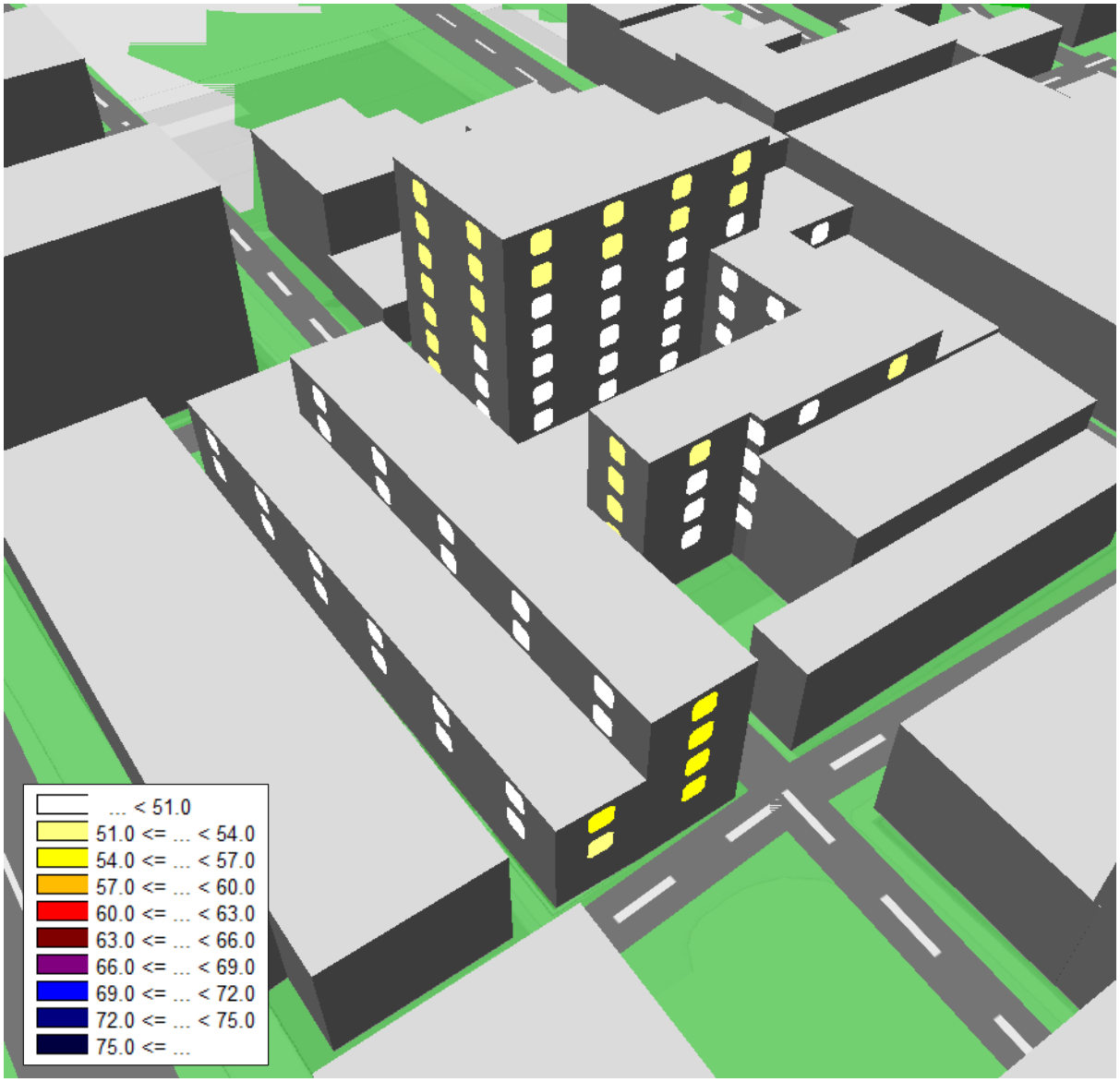
Daytime Incident $L_{Aeq,16hr}$ Noise Levels (from south)



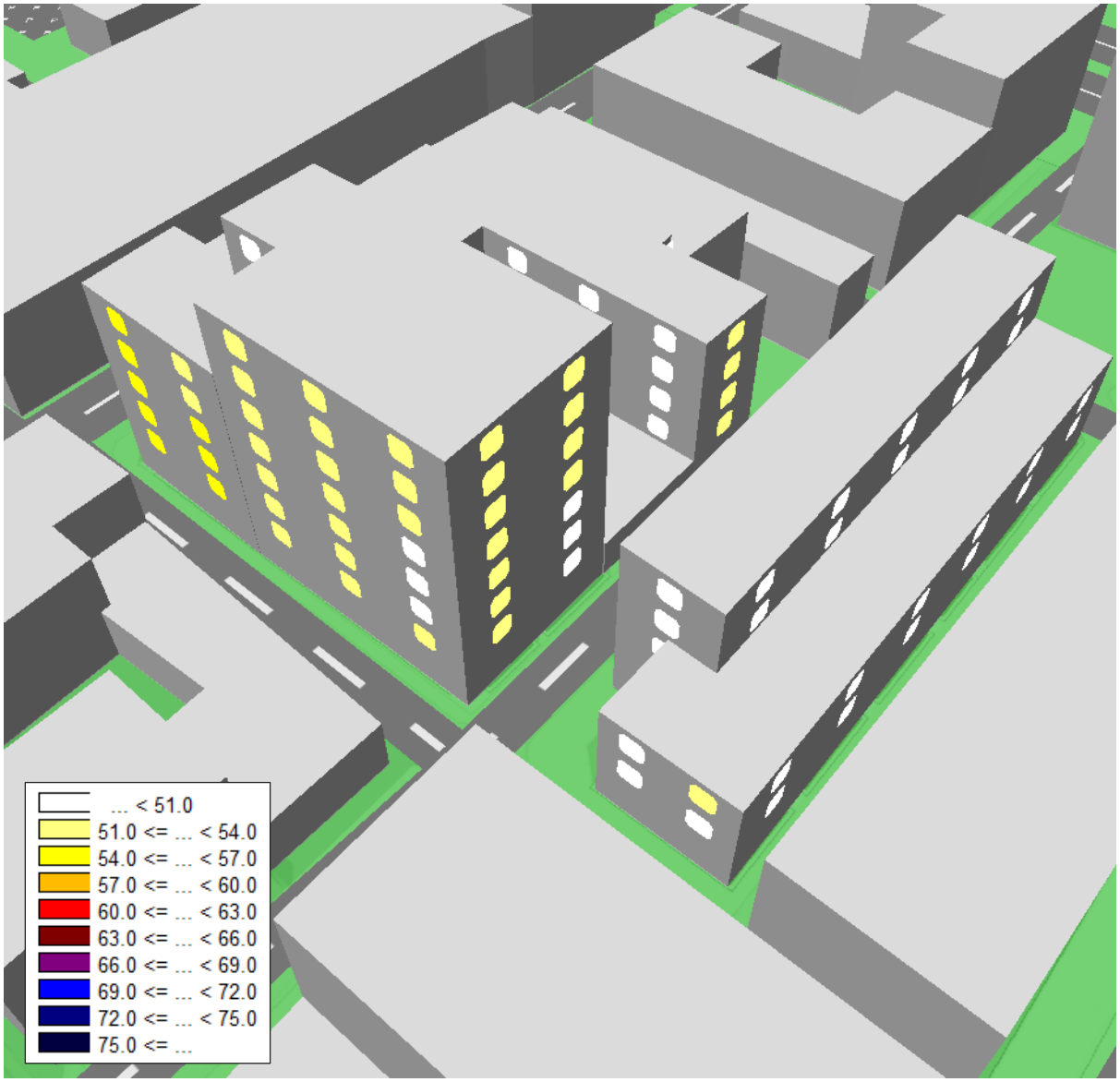
Night-time Incident $L_{Aeq,8hr}$ Noise Levels (from west)



Night-time Incident $L_{Aeq,8hr}$ Noise Levels (from north)



Night-time Incident $L_{Aeq,8hr}$ Noise Levels (from east)



Night-time Incident $L_{Aeq,8hr}$ Noise Levels (from south)