025214-R03-C

8 May 2026

10-12 Whitworth Street West

Noise and vibration planning report

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Version	Date	Comments	Author	Reviewer
A	6 Mar 26		SC	MR
B	9 Mar 26	Minor updates to the facade sound insulation assessment	SC	MR
C	8 May 26	Revision following comments	SC	MR

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Summary

Sandy Brown has been commissioned by Atri7 6 Limited to provide acoustic advice in relation to the proposed development at 10-12 Whitworth Street West, Manchester, M1 5WY.

An environmental noise and vibration survey has been carried out at the site. The noise survey was carried out between 13 January 2023 and 17 January 2023. The ground-borne vibration survey was undertaken on 6 March 2025.

Based on the requirements of Manchester City Council and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15min}$ 49 dB during the day and $L_{Aeq,15min}$ 42 dB during the night.

The average ambient noise levels measured during the survey were $L_{Aeq,16h}$ 64 dB during the day and $L_{Aeq,8h}$ 63 dB at night.

Predicted incident maximum noise levels are between $L_{AFmax,2min}$ 55 dB and $L_{AFmax,2min}$ 85 dB.

The nightclub El Diablo was not open on the night of 13 January 2023, and the dominant entertainment noise source was the nightclub, Lola Lo.

An initial assessment has been carried out to determine required acoustic performances for the facades and provide guidance on the ventilation strategy. The required overall facade sound insulation performances range from R'_w+C_{tr} 24 dB to R'_w+C_{tr} 40 dB, with specific low frequency sound insulation performance requirements for spaces affected by entertainment noise ingress.

Open windows to bedrooms at night can likely not be relied upon as a method to remove excess heat, and the 'dynamic thermal modelling method' will need to be used to demonstrate compliance with the requirements of ADO2021.

For tactile vibration from the nearby railway, the predicted equivalent VDVs, during the day and night periods are lower than the thresholds of the BS 6472 'low probability of adverse comment' categories.

Levels experienced may vary depending on the type of train and position of the future buildings. However, the majority of the calculated VDVs are below the lowest BS 6472 threshold, and a significant increase in the number of trains would be required for the threshold to be exceeded. Based on this, tactile vibration due to trains is unlikely to be problematic for this development.

Of the train passes captured during the survey period, all the predicted ground-borne noise levels were lower than criteria proposed by MCC. The predicted values are for worst-case lower-level student accommodation. Noise levels from this source are expected to be lower at upper floor levels.

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1 Introduction

Sandy Brown has been commissioned by Atri7 6 Limited to provide acoustic advice in relation to the proposed development at 10-12 Whitworth Street West, Manchester, M1 5WY.

Environmental noise and vibration surveys have been carried out to establish:

- background sound levels around the site and by nearby noise sensitive premises
- ambient and maximum noise levels at the site
- vibration levels affecting the site.

The background sound levels measured during the survey are used as the basis for setting limits for noise emission from proposed building services plant. These limits are set in accordance with the requirements of the Manchester City Council.

Ambient and maximum noise levels are used to assess building envelope sound insulation requirements to achieve appropriate internal noise levels for residences. These follow standards set in accordance with Manchester City Council guidelines.

Vibration levels are used to assess the degree to which the proposed development will be affected by tactile vibration and ground-borne noise from the railway adjacent to the site.

This report provides details of the noise and vibration surveys, including measurement results, and provides recommendations.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown outlined in red in Figure 1.

The proposed site is on the south-west corner of the intersection between Whitworth Street West and Albion Street.



Figure 1 Aerial view of site (courtesy of Google Earth Pro)

2.2 Adjacent premises

The site is close to the following premises:

- Hilltop apartments – residential (highlighted in green in Figure 1)
- Bars and clubs on Deansgate Locks – noted as a noise source during the survey (highlighted in blue in Figure 1). From east to west:
    - El Diablo (closed during measurement period) – Typical opening hours, 17:00-02:00 (weekday), 17:00-04:00 (Friday), 12:00-17:00 (Saturday). No longer operational as of October 2023.
    - Lola Lo (open during measurement period) – Typical opening hours, 20:00-03:00 (Thursday), 18:00-03:00 (Friday), 17:00-03:00 (Saturday). No longer operational as of January 2024.
    - Salsa En (open during measurement period) – Typical opening hours, 19:00-03:00 (Friday)
    - Popworld (open during measurement period) – Typical opening hours, 21:00-04:00 (Thursday), 20:00-04:00 (Friday), 17:00-04:00 (Saturday)
- 2 Whitworth Street West – Commercial unit (highlighted in pink in Figure 1).

Additionally, Rebellion (music venue and club space) is located at2B Whitworth Street west, 92 m to the west.

Additionally, there is a railway line forming the southern boundary of the site, including Deansgate railway station (highlighted in yellow in Figure 1).

3 Development proposals

The development is proposed to be redeveloped to form student accommodation over 39 storeys. The accommodation is proposed to comprise studio apartments, and social suites.

3.1 Potential noise sources

The potential noise sources associated with the scheme can be broadly divided into two categories:

- Building services plant
- Internal activity in amenity areas

The potential impact of these sources has been assessed and mitigation measures have been proposed to minimise impact on existing noise sensitive premises around the development.

4 Assessment criteria

4.1 NPPF and NPSE

The National Planning Policy Framework, December 2024 (NPPF) sets out the UK government's planning policies for England. It supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF, clause 198 states:

> *'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> - *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.*
> - *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

and clause 200 states:

> *'Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'*

The NPSE states that its aims are as follows:

> *'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
>
> - *Avoid significant adverse impacts on health and quality of life*
> - *Mitigate and minimise adverse impacts on health and quality of life and*
> - *Where possible, contribute to the improvement of health and quality of life.'*

As such, neither document sets out specific acoustic criteria for new residential developments, but they require consideration of the effect of existing noise on the new development and the effect of noise from the development on the surroundings.

4.2 Noise egress

4.2.1 Standard guidance

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background sound level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

4.2.2 Local Authority criteria

Manchester City Council (MCC) provides guidance in relation to plant noise emissions in their *Planning and Noise* document October 2022. The following is stipulated:

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

4.3 Noise ingress

4.3.1 Local Authority requirements

Section 3.7.7.1 of MCC document *Planning and Noise* dated October 2022 provides the following internal noise limits for residential premises.

- Bedrooms (night— 23:00–07:00), L_{Aeq} 30 dB (individual noise events should not normally exceed L_{AFmax} 45 dB by more than 10 times
- Living rooms (day— 07:00–23:00), L_{Aeq} 45 dB
- Gardens and terraces (day), L_{Aeq} 55 dB.

These criteria are based on the guidance provided in BS 8233:2014 (discussed below).

Section 3.7.1.2 of the same document stipulates the following low-frequency internal noise limits for new residential developments close to entertainment venues:

> *'Music noise levels in the 63 Hz and 125 Hz octave centre frequency bands should be controlled so as not to exceed (in habitable rooms) 47 dB and 41 dB (L_{eq}), respectively.'*

From discussions with Manchester City Council it is understood that the low frequency noise criteria only apply to living-areas during the day (07:00-23:00) and to bedrooms during night (23:00-07:00).

4.3.2 British Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings*. The guidance limits are shown in Table 1.

These internal levels are based on annual average data and do not have to be achieved in all circumstances. It is normal to exclude occasional events, such as fireworks night or New Year's Eve.

Table 1 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level, L_{Aeq} (dB)	
	Day (07:00–23:00)	Night (23:00–07:00)
Living rooms	35	-
Dining room	40	-
Bedrooms	35	30[1]

[1] BS 8233 notes that individual noise events can cause sleep disturbance, and that a guideline value may be set depending on the character and number of events per night, although no specific limit is provided. For regular events, such as scheduled aircraft or passing trains, a guideline value may be set in terms of SEL or $L_{Amax,F}$. Sporadic noise events could require separate values.

The standard states that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

For external amenity areas, such as gardens and patios, the standard states:

> *'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, 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.'*

4.3.3 ProPG

Internal noise ingress criteria in ProPG are the same as in BS 8233:2014 but additional guidance is provided. In relation to regular individual noise events the following additional guidance is provided:

> *'In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.'*

4.3.4 Approved Document O – Overheating

Approved Document O 2021 Edition (to the Building Regulations 2010) states the following in relation to noise ingress during overheating periods:

> *'In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (23:00-07:00 hours).*
>
> *Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.*
>
> a. $L_{Aeq,T}$ *40 dB average over 8 hours (between 23:00-07:00)*
> b. L_{AFmax} *55 dB more than 10 times a night (between 23:00-07:00).'*

The above applies to residential dwellings, institutional residential accommodation, and other types of residential accommodation, such as student accommodation.

4.3.5 Acoustics, ventilation and overheating

Guidance on external noise levels from transport noise sources and the assessment of risk in an overheating condition is given in the Association of Noise Consultants *Acoustics Ventilation and Overheating, Residential Design Guide* (AVO Guide). The guidance for internal noise levels during the night for an overheating condition set out in AVO Guide is superseded by the requirements set out in ADO2021 and therefore is provided for information only.

A Level 1 assessment comprises assessing the external free-field noise levels to guideline thresholds. External noise levels and the associated risk categories for a Level 1 assessment are adapted and summarised in Table 2, though consideration also has to be given the duration and frequency of any overheating periods.

Table 2 Guidance for Level 1 assessment of noise from transport sources relating to overheating condition

Risk category for Level 1 assessment	External free-field noise level	
	Day (07:00–23:00)	Night (23:00–07:00)
Negligible	$L_{Aeq} \leq 52$ dB	$L_{Aeq} \leq 47$ dB
Low	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 57$ dB	$L_{Aeq} > 47$ dB and $L_{Aeq} \leq 52$ dB
Medium	$L_{Aeq} > 57$ dB and $L_{Aeq} \leq 62$ dB	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 55$ dB
High	$L_{Aeq} > 62$ dB	$L_{Aeq} > 55$ dB

If a Level 1 assessment finds that the development falls into a 'Medium' or 'High' risk category a Level 2 assessment should be carried out, assessing the expected internal noise levels for an overheating condition and the associated risk of adverse effect.

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4.4 Tactile vibration criteria

4.4.1 Standard guidance

Tactile vibration is that which is perceived as mechanical motion. BS 6472-1:2008 *Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting* provides procedures for assessing the potential human response to vibration.

Vibration is assessed in terms of the equivalent vibration dose value (VDV). This relates the level and duration of vibration.

The BS 6472-1:2008 assessment criteria are presented in Table 3.

Table 3 BS 6472-1: 2008 tactile vibration assessment criteria

VDV ($m/s^{1.75}$) above which might result in various probabilities of adverse comment within residential buildings.			
Place	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16 hr day	0.2–0.4	0.4–0.8	0.8–1.6
Residential building 8 hr night	0.1–0.2	0.2–0.4	0.4–0.8

It is important to note that people exhibit wide variations of vibration tolerance. Specific values are dependent upon social and cultural factors, psychological attitudes and expected degree of intrusion.

4.4.2 Local Authority requirements

Manchester City Council do not provide specific criteria for tactile vibration, however they do state the following in their standard planning guidance:

> *'A vibration assessment (which is usually based on BS 6472: 2008) will be required where railway/tramlines are within 20 m of a proposed development site. It is important that vibration issues are considered, and measurement data supplied in the report, together with mitigation proposals if vibration without these works has been identified as a potential problem.'*

As the proposed development is with 20 m of the railway line, tactile vibration has been assessed in line with the criteria outlined in BS 6472-1:2008.

4.5 Ground-borne noise

There is currently no international or British Standard which provides guidance on assessing the impact of ground-borne noise from railways on the occupants of a building. The Association of Noise Consultants (ANC) guidelines '*Measurement and assessment of*

ground-borne noise and vibration', 2nd edition published in 2012, is generally used as the basis of assessments such as this.

This document also provides discussion on the relevant research that has been carried out, and a summary of typically adopted criteria.

The most relevant items are set out below:

- The American Public Transit Association (APTA) guidelines recommend criteria of between 30 and 40 dB(A) depending on the density and type of residential properties. They do not define where within a building these apply, or the time response that should be used.
- The Federal Transit Administration (FTA) of the US Department of Transportation, recommends limits for maximum pass-by levels of 35 dB(A) for frequent events (more than 70 events per day) and 43 dB(A) for infrequent events.
- London Underground Limited has studied the relationship between ground-borne noise levels and complaint thresholds. This was used to define a complaint threshold of L_{AFmax} 40 dB.
- The ANC guidelines also note that Local Authority guidelines for ground-borne noise were published in London and the South East, and state a limit of L_{AFmax} 35 dB.

In all the above examples, the time constant is not defined, with the exception of the Local Authority guidelines in London and the South East, which is defined as having a fast time weighting.

It should be noted that most of this research relates to residential accommodation and is aimed at providing good sleeping/resting conditions.

4.5.1 Local Authority requirements

Manchester City Council do not provide specific criteria for ground-borne noise from railways on the occupants of a building. It is understood that submitted reports for the previous scheme on this site have established that the night-time bedroom maximum noise level criterion of L_{AFmax} 45 dB should be used to assess ground-borne noise from the nearby railway.

5 Survey method

5.1 Noise survey method

The survey included unattended and attended noise measurements.

The measurements and information provided in this report are in accordance with requirements of BS 7445, as referenced in Appendix A.

5.1.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 4 days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements were taken over 15 minute periods between 16:00 on 13 January 2023 and 14:15 on 17 January 2023. It is noted that a live music event was held at Rebellion on 16 January 2023.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided in Figure 2. This location was chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.



Figure 2 Photograph of the unattended logger position

5.1.2 Attended measurements

Attended sample measurements were taken at 4 locations around the site. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out on 13 January 2023, over 5 minute periods.

At each position the microphone was mounted on a tripod approximately 1.5 m above the ground level and at least 1.5 m from any other reflective surface (ie, free field). Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.

5.2 Weather conditions

Weather conditions during the survey are described in Appendix A.

5.3 Vibration survey method

Ground-borne vibration measurements were taken at 2 locations around the site in order to determine the vibration levels resulting from the passage of trains on the railway tracks elevated on a viaduct adjacent to the site. The vibration measurement locations are indicated in as positions V1 and V2.

Measurement position V1 was located on an exposed existing pile (pile 81 on the piling plan).

Measurement position V2 was located on the ground at approximately equal distance (18 m) from the railway.

The measurements were taken on 6 March 2025 between 10:45 and 13:00. Measurement periods containing multiple train events (both passenger and freight trains) were obtained during the survey.

Two accelerometers were set up: one to measure vibration dose values (VDV) and one for one-third octave band slow weighted RMS acceleration. The VDV measurements were taken to establish levels of tactile vibration while the one-third octave band slow weighted RMS acceleration measurements were used for purposes of the ground-borne L_{ASmax} prediction. The accelerometers were mounted directly to the exposed concrete pile with beeswax for position V1, and on the ground using a DIN plate for position V2.

The VDV measurements were conducted in three axes as follows:

- X axis – Horizontal vibration approximately parallel to the railway tracks
- Y axis – Horizontal vibration approximately perpendicular to the railway tracks
- Z axis – Vertical vibration.

Details of the equipment used, and the vibration indices measured are provided in Appendix A.

Photographs of the measurement positions are provided in Figure 3.



Figure 3 Photographs of measurement positions V1 (left) and V2 (right)

The vibration measurements taken at both locations are considered to be reasonably representative of the vibration levels to be experienced by the proposed residential premises.

6 Measurement results

6.1 Observations

6.1.1 Noise

The dominant noise sources observed at the site during the survey were from road traffic during the day from Whitworth Street West, and train noise noted, with club noise being audible during the night from Deansgate Locks premises.

Less significant noise sources included tram noise from Deansgate Castlefield, and pedestrian noise from Whitworth Street West.

6.1.2 Vibration

Subjectively there was no perceptual vibration at the measurement location with the exception of the freight train pass at 10:52.

6.2 Noise measurement results

6.2.1 Unattended measurement results

A graph showing the results of the unattended measurements is provided in Appendix B.

Ambient noise levels measured during the day and night, during the unattended survey are presented in Table 4.

Table 4 Ambient noise levels measured during the unattended survey

Date	Day (07:00–23:00) $L_{Aeq,16h}$ (dB)	Night (23:00–07:00) $L_{Aeq,8h}$ (dB)
Friday 13 January 2023	64[1]	65
Saturday 14 January 2023	65	65
Sunday 15 January 2023	63	59
Monday 16 January 2023	64	60
Tuesday 17 January 2023	65[1]	-
Average	64	63

[1] Measurement not made over full period due to monitoring start and end time (the measurement on 13 January 23 was over 6 hours, and on 7 January 23 was over 6 hours); not included in the average.

Analysis of the maximum noise levels during the night indicates that the night-time maximum noise level not normally exceeded 10 times a night is $L_{AFmax,2min}$ 83 dB during Friday and Saturday night, and $L_{AFmax,2min}$ 79 dB during Sunday and Monday night.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Day and night statistical analysis of representative values for the site are given in Figure 4.

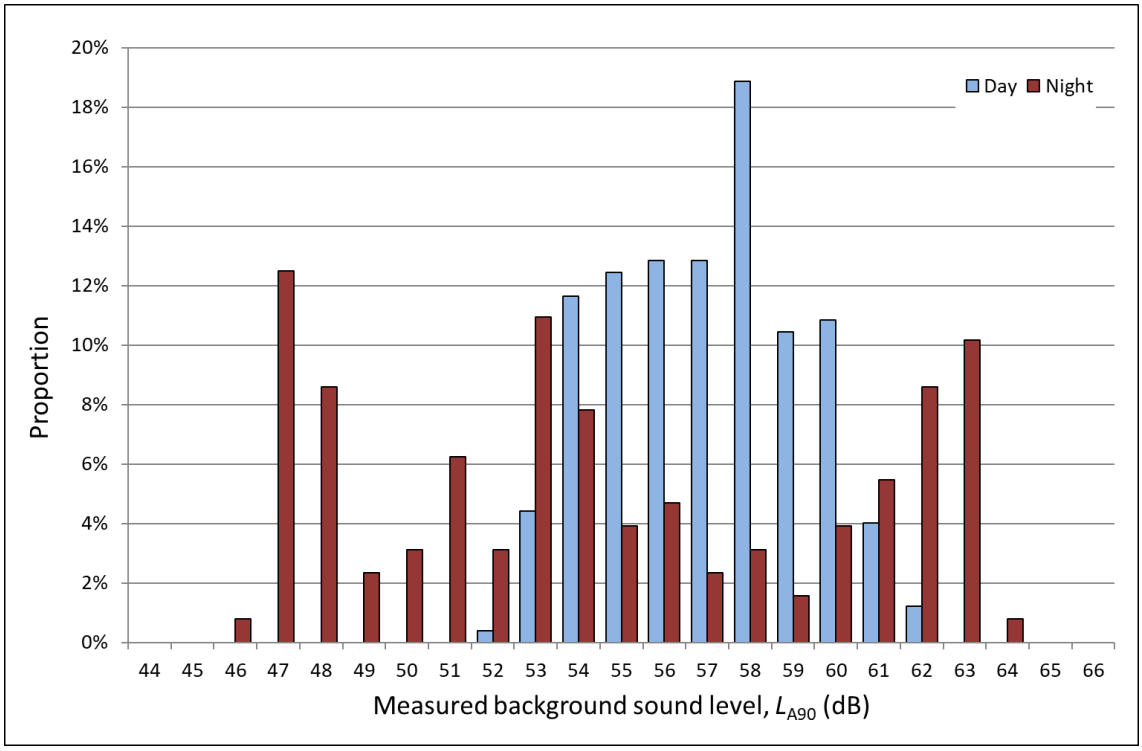


Figure 4 Day and night statistical analysis of background sound levels

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 54 dB during the day and $L_{A90,15min}$ 47 dB at night.

The measured representative octave-band background sound levels are provided in Table 5.

Table 5 Representative background sound pressure levels measured during the survey

Time period	Background sound level, $L_{90,15min}$ (dB) Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Day (07:00-23:00)	56	52	50	50	52	45	40	33
Night (23:00-07:00)	45	43	42	43	44	38	34	28

6.2.2 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 6.

Table 6 Noise levels and key noise sources from attended measurements – Day

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	16:00	69	83	60	At all position 1 measurements: Road traffic from Whitworth Street West dominating, occasional tram noise audible.
1	16:06	67	77	60	
1	16:11	68	80	60	
1	16:17	70	84	62	Max from car exhaust
1	16:22	68	78	61	
1	16:27	68	77	60	
1	16:32	68	76	61	
1	16:37	68	83	60	Max from bus passing
1	16:45	68	80	61	
1	16:50	71	81	66	
1	16:55	69	81	64	
1	17:00	67	86	60	
2	16:05	69	80	59	All position 2 measurements: Whitworth Street West road traffic dominating, train noise and pedestrian noise audible
2	16:10	69	80	61	
2	16:15	79	104	61	Max from pedestrian shouting into mic (not included in assessment)
2	16:20	71	86	60	Freight train pass noted.

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
2	16:26	69	83	63	Passenger train passes noted at each position – dominant noise source road traffic
2	16:31	69	81	60	
2	16:37	69	79	61	
2	16:42	69	80	60	
2	16:47	69	86	62	
2	16:52	68	80	60	
2	16:57	69	83	60	
2	17:04	70	86	60	
3	17:20	55	67	53	No train passes
3	17:25	58	73	53	One passenger train westbound
3	17:30	59	80	52	One passenger train eastbound
3	17:36	64	81	53	One passenger train eastbound
3	17:41	67	81	53	Two westbound and two eastbound passenger trains.
3	17:46	66	83	52	One eastbound and one westbound passenger train. Emergency siren from Whitworth St West
3	17:51	67	82	53	Two westbound and one eastbound passenger train.
3	17:56	69	88	54	One eastbound and one westbound train pulling out of station. Overhead plane.
3	18:05	66	83	55	Two eastbound and one westbound train

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
3	18:10	61	77	53	One westbound and one eastbound passenger plane
3	18:15	67	86	53	One eastbound passenger train, one westbound passenger train, one freight train near end of measurements
3	18:20	64	82	53	Freight train from previous measurement continued.
4	17:15	66	80	58	At all position 4 measurements: Road noise dominating, passenger trains passes audible at each measurement
4	17:20	66	81	59	
4	17:26	65	78	60	
4	17:31	66	79	60	
4	17:36	66	75	59	
4	17:41	67	77	59	
4	17:46	65	74	60	
4	17:53	65	84	59	
4	17:58	67	85	61	
4	18:03	66	82	60	
4	18:08	65	79	60	
4	18:13	67	93	60	Max from car engine revving

Table 7 Noise levels and key noise sources from attended measurements – Evening

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	21:31	65	78	58	
1	21:36	66	83	58	At all position 1 measurements: Road traffic/pedestrian dominating.
1	21:41	65	79	60	
1	21:46	65	76	59	
1	21:52	68	85	61	Max from car exhaust
1	21:57	66	83	58	Max from bus pass
1	22:05	65	80	57	
1	22:11	66	77	61	
1	22:16	67	82	59	Max from car exhaust
1	22:22	67	77	60	
1	22:27	67	76	61	
1	22:32	66	78	60	
2	21:35	65	79	58	All position 2 measurements: Road traffic dominating, passenger train passes noted during each measurement
2	21:40	66	80	58	
2	21:46	66	76	59	
2	21:51	68	79	58	
2	22:00	68	86	60	Max caused by loud car engine
2	22:06	66	77	59	
2	22:12	67	80	58	
2	22:17	68	83	60	
2	22:22	68	79	59	
2	22:27	69	80	60	
2	22:32	69	78	60	
2	22:37	68	79	60	

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
3	20:05	63	82	53	One eastbound and one westbound passenger train pass
3	20:10	63	77	53	One westbound passenger train pass
3	20:16	66	85	52	One eastbound passenger train pass
3	20:21	54	64	53	No train passes
3	20:26	67	82	54	Two westbound and one eastbound passenger train passes
3	20:32	67	85	52	One eastbound passenger train pass
3	20:38	66	81	53	One eastbound passenger train pass
3	20:45	67	84	52	Two westbound passenger train passes
3	20:50	54	63	52	No train passes
3	20:55	65	82	53	One eastbound and two westbound passenger train passes
3	21:00	69	99	52	One eastbound and one westbound pass. Max caused by horn from train
3	21:06	67	84	53	One eastbound and one westbound passenger train pass
4	20:05	65	81	60	At all position 4 measurements: Road traffic dominating, Clubs opened at this time but no music audible
4	20:10	65	75	59	
4	20:15	66	86	60	Max from car horn

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
4	20:20	64	75	59	
4	20:25	65	75	60	
4	20:30	65	74	59	
4	20:35	64	73	58	
4	20:40	64	77	58	
4	20:46	65	76	60	
4	20:51	66	80	58	Max from loud car engine
4	20:56	65	79	59	
4	21:01	65	75	59	

Table 8 Noise levels and key noise sources from attended measurements – Night

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	23:00	65	78	60	Road traffic dominating but club music audible. Club music (from Lola Lo) noted to be dominant during periods of low traffic.
1	23:05	67	78	63	
1	23:10	67	87	61	Max from nearby pedestrians
1	23:15	70	88	63	Max from emergency siren
1	23:21	66	82	62	
1	23:26	66	77	62	
2	23:35	68	79	61	At position 2: Club noise egress inaudible, road traffic dominating.
2	23:40	68	78	61	

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
2	23:45	68	82	61	
2	23:50	68	86	58	Max from passing pedestrian shouting (not close to mic)
2	23:55	68	84	61	
2	00:00	67	78	61	
4	23:00	68	80	59	Club noise (from Lola Lo) egress and smoking area use fairly loud at all measurements at position 4
4	23:05	68	80	63	
4	23:10	67	79	64	
4	23:16	67	78	64	
4	23:22	68	81	65	
4	23:27	68	82	65	
4	23:32	68	80	65	
4	23:37	68	77	65	
4	23:42	72	88	65	Max caused by loud car engine.
4	23:55	68	84	65	
4	00:00	68	79	65	
4	00:06	69	85	64	

The worst-case club noise measurement (from position 4 at 23:42) was dominated by music from Lola Lo. The octave-band measurements from this period are summarised in Table 9.

Table 9 Octave band noise levels from attended measurements – Worst entertainment noise (night)

Measurement	Measured sound pressure level, $L_{Aeq,5min}$ (dB) Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Position 4 (23:42)	82	68	66	71	68	63	58	50

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6.3 Vibration measurement results

VDVs measured at position V1 are presented in Table 10 and position V2 in Table 11. The maximum VDVs measured for each of the directions are highlighted in red.

Table 10 VDVs measured at position V1 (exposed existing pile)

Start time	Number of events	VDV ($m/s^{1.75}$)		
		X-axis	Y-axis	Z-axis
10:44	0	0.00033	0.00036	0.00081
10:45	0	0.00036	0.00035	0.00077
10:46	1	0.00064	0.00081	0.00132
10:47	0	0.00032	0.00028	0.00065
10:48	0	0.00038	0.00035	0.00075
10:49	0	0.00042	0.00038	0.00084
10:50	0	0.00058	0.00050	0.00125
10:51	1	0.00115	0.00128	0.00196
10:52	1	0.00186	0.00226	0.00344
10:53	1	0.00117	0.00140	0.00249
10:54	0	0.00037	0.00035	0.00084
10:55	0	0.00052	0.00058	0.00108
10:56	0	0.00060	0.00047	0.00092
10:57	0	0.00056	0.00051	0.00105
10:58	1	0.00069	0.00072	0.00130
10:59	0	0.00033	0.00039	0.00093
11:00	1	0.00060	0.00052	0.00101
11:01	0	0.00056	0.00067	0.00108
11:02	1	0.00076	0.00091	0.00137
11:03	0	0.00050	0.00043	0.00111
11:04	0	0.00056	0.00056	0.00098
11:05	1	0.00067	0.00057	0.00114
11:06	1	0.00080	0.00098	0.00198
11:07	0	0.00042	0.00038	0.00092

Start time	Number of events	VDV ($m/s^{1.75}$)		
		X-axis	Y-axis	Z-axis
11:08	0	0.00045	0.00046	0.00114
11:09	1	0.00059	0.00055	0.00121
11:10	0	0.00062	0.00056	0.00116
11:11	1	0.00086	0.00123	0.00165
11:12	1	0.00051	0.00053	0.00104
11:13	0	0.00061	0.00060	0.00123
11:14	0	0.00027	0.00028	0.00059
11:15	1	0.00069	0.00081	0.00118
11:16	0	0.00058	0.00057	0.00098
11:20	0	0.00038	0.00042	0.00087
11:21	1	0.00088	0.00099	0.00160
11:22	0	0.00045	0.00035	0.00080
11:23	0	0.00026	0.00024	0.00060
11:24	1	0.00068	0.00054	0.00120
11:35	1	0.00065	0.00077	0.00116
11:36	1	0.00072	0.00063	0.00113
11:37	0	0.00033	0.00030	0.00061
11:38	1	0.00063	0.00062	0.00122
11:39	0	0.00037	0.00041	0.00076

[1] Measurements of RMS acceleration are presented in Appendix C.

Table 11 VDVs measured at position V2 (unmade ground)

Start time	Number of events	VDV ($m/s^{1.75}$)		
		X-axis	Y-axis	Z-axis
12:04	1	0.00032	0.00038	0.00308
12:05	0	0.00027	0.00032	0.0018
12:06	0	0.00066	0.00074	0.0051
12:07	1	0.00051	0.00055	0.00373
12:09	1	0.00074	0.00099	0.0099

Start time	Number of events	VDV ($m/s^{1.75}$)		
		X-axis	Y-axis	Z-axis
12:10	1	0.00042	0.00069	0.00344
12:11	0	0.00038	0.00045	0.0029
12:12	1	0.00061	0.00056	0.00606
12:13	1	0.00067	0.00085	0.00675
12:14	0	0.00047	0.00055	0.00431
12:15	1	0.00053	0.00067	0.00645
12:16	1	0.00046	0.00058	0.00637
12:17	0	0.00041	0.00054	0.00365
12:18	0	0.00039	0.00041	0.00336
12:19	0	0.00029	0.00036	0.00235
12:20	1	0.00073	0.00129	0.01027
12:21	0	0.00036	0.00043	0.00316
12:22	1	0.00053	0.00064	0.00432
12:23	0	0.00031	0.00037	0.00274
12:24	0	0.00039	0.00047	0.00335
12:25	0	0.0003	0.00034	0.0031
12:26	1	0.00045	0.0005	0.00364
12:27	0	0.00038	0.00044	0.00311
12:28	0	0.00027	0.0003	0.00189
12:29	1	0.0005	0.00062	0.00363
12:34	0	0.00037	0.00039	0.00281
12:35	0	0.00042	0.00047	0.00269
12:36	1	0.00053	0.00068	0.00516
12:37	1	0.00058	0.00094	0.00951
12:38	1	0.00053	0.00065	0.00476
12:39	0	0.00032	0.00039	0.00295
12:40	0	0.00029	0.00027	0.00179
12:43	1	0.00061	0.00076	0.00586
12:44	0	0.00039	0.00047	0.00335

Start time	Number of events	VDV (m/s$^{1.75}$)		
		X-axis	Y-axis	Z-axis
12:45	0	0.00062	0.00089	0.00523
12:46	0	0.0004	0.00057	0.00367
12:47	1	0.00047	0.00052	0.00463
12:48	1	0.00074	0.0011	0.01071
12:49	0	0.00049	0.00058	0.00464
12:50	0	0.00032	0.00031	0.00232
12:51	0	0.00031	0.00035	0.00224
12:52	1	0.00072	0.00091	0.00836
12:53	0	0.00053	0.00071	0.0047
12:54	0	0.00046	0.00059	0.0039
12:55	1	0.00042	0.00046	0.00293

[1] Measurements of RMS acceleration are presented in Appendix D.

7 Plant noise egress

7.1 Limits

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 12.
The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels. In this case these limits would apply at all noise sensitive receptors identified in Figure 1.

Table 12 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Day (07:00–23:00)	49
Night (23:00–07:00)	42

[1] The limits set out in Table 12 do not include any attention catching features. The penalty corrections for attention catching features may be significant, and will need to be considered as the building services design progresses. This is discussed in Appendix H.

7.2 Assessment

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features. Assessment has been undertaken to ensure that the proposed design meets the plant noise egress criteria at the nearby noise sensitive premises.

8 Facade sound insulation

This section describes an assessment of facade sound insulation to control noise ingress. The required facade specification largely depends on the external noise levels and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS 8233:2014 and by Manchester City Council.

8.1 Environmental noise modelling

A 3D environmental noise model of the site and the surrounding area has been created using CadnaA software by Datakustik. The models allows for an assessment of noise ingress by incorporating the screening that the proposed building will provide when it is completed.

The model and initial assessment currently considers existing and previously observed sources of environmental and entertainment noise. Any new sources of noise within the scheme will need to be considered as the design progresses.

The software carries out calculations using a ray tracing technique. This takes account of the effects of topography, reflections, screening and distance attenuation for noise sources to predict noise levels in three dimensions. Calculations are carried out in accordance with ISO 9613 (2024) *Attenuation of sound during propagation outdoors*.

The predicted external noise levels from the 3D environmental noise model are shown below. Figure 5 to Figure 6 provide of the expected external day noise levels at the facade. Figure 7 to Figure 8 show the expected night noise levels at the facade. The worst case predicted ambient noise levels incident on the facade are presented in Appendix E. The worst case predicted maximum noise levels incident on the facade are presented in Appendix F.

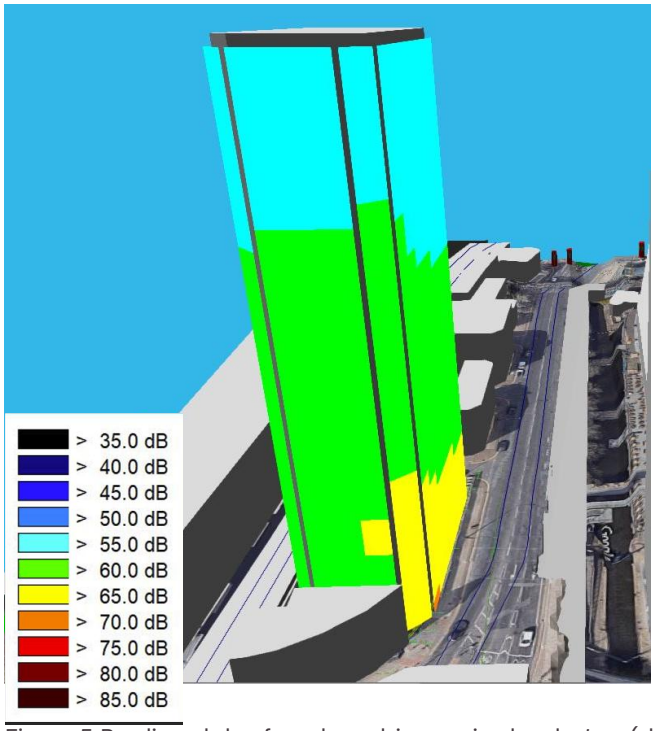


Figure 5 Predicted day facade ambient noise levels, L_{Aeq} (dB) – north and east

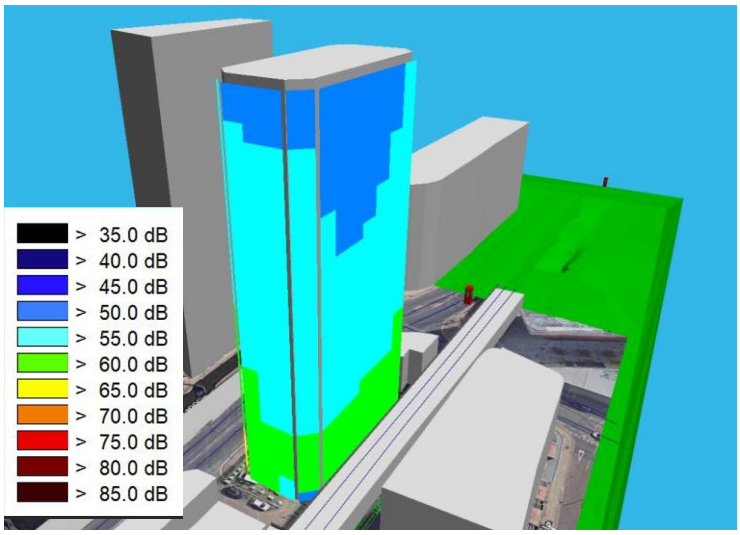


Figure 6 Predicted day facade ambient noise levels, L_{Aeq} (dB) – south and west

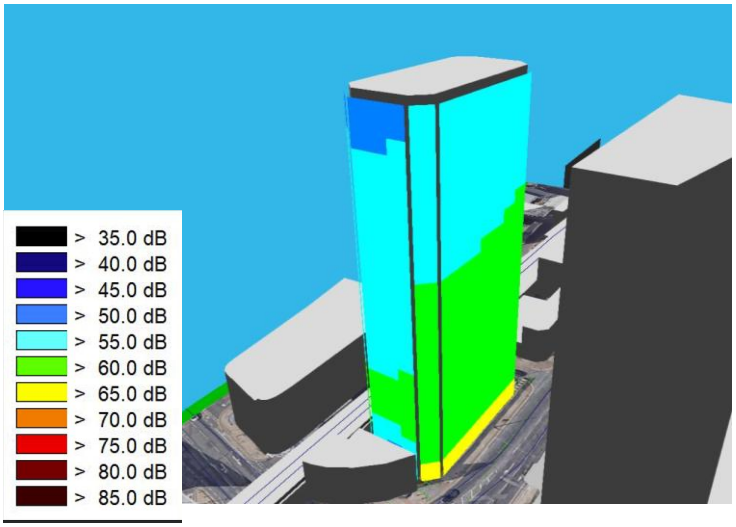


Figure 7 Predicted night facade ambient noise levels, L_{Aeq} (dB) – north and east

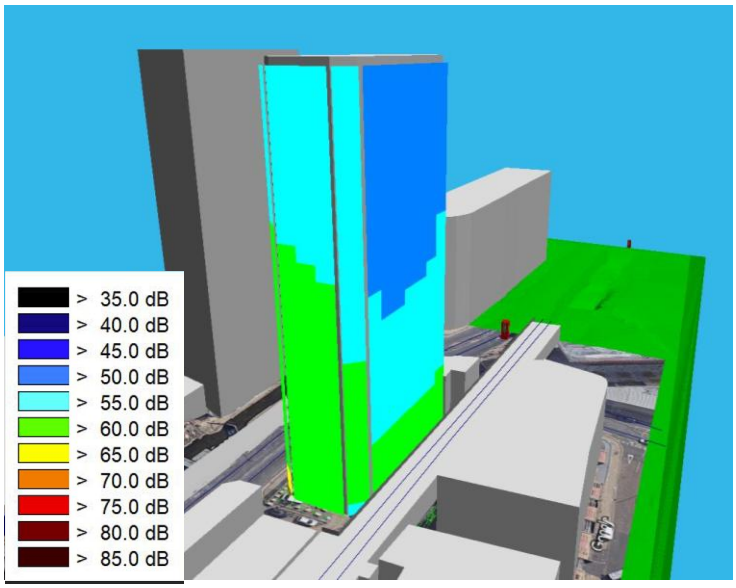


Figure 8 Predicted night facade ambient noise levels, L_{Aeq} (dB) – south and west

8.2 Noise egress

Noise egress via the building envelope from internal equipment and activities will need to be considered during the design. This is to ensure noise transfer to nearby noise sensitive premises, external accessible areas and back into other parts of the building is controlled.

Noise egress will need to be considered from plant rooms. Atmospheric terminations are recommended to be ducted to the facade via attenuators.

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8.3 Facade sound insulation

An assessment of the facade sound insulation performance requirements has been carried out based on the current design information and results of the site noise measurements.

The nightclub El Diablo was closed at the time of the environmental noise survey (13 January 2023), and the dominant entertainment noise source was the nightclub, Lola Lo. Both these nightclubs are now closed and the units are vacant. It is assumed that similar nightclubs could open in their place.

The individual unit layouts have not been confirmed at this stage, however the majority of these are studios, and the requirements have been set based on criteria for bedrooms. It is assumed that the studio dimensions are approximately:

- 2.6 m x 5.8 m x 2.9 m (width x depth x height)
- Reverberation time of 0.5 s.

The required sound insulation performances for each facade are set out in Table 13.

A mark-up showing the minimum overall sound insulation requirements for the student accommodation is set out in Appendix G.

Table 13 Minimum studio accommodation facade sound insulation performance requirements

Facade	Minimum overall sound insulation performance	Minimum low-frequency sound insulation performance
North		
Level 2 to Level 12	R'_w+C_{tr} 40 dB	R'_{63Hz} 22 dB R'_{125Hz} 19 dB
Level 13 to Level 26	R'_w+C_{tr} 33 dB	R'_{63Hz} 19 dB R'_{125Hz} 16 dB
Level 27 to Level 38	R'_w+C_{tr} 30 dB	R'_{63Hz} 18 dB R'_{125Hz} 14 dB
South		
Level 2 to Level 9	R'_w+C_{tr} 40 dB	
Level 10 to Level 22	R'_w+C_{tr} 33 dB	
Level 23 to Level 38	R'_w+C_{tr} 30 dB	
East		
Level 2 to Level 29	R'_w+C_{tr} 33 dB	
Level 30 to Level 38	R'_w+C_{tr} 30 dB	

Facade	Minimum overall sound insulation performance	Minimum low-frequency sound insulation performance
West		
Level 2 to Level 17	R'_w+C_{tr} 40 dB	R'_{63Hz} 22 dB R'_{125Hz} 18 dB
Level 18 to Level 38	R'_w+C_{tr} 30 dB	R'_{63Hz} 16 dB R'_{125Hz} 12 dB

8.3.1 Amenity space

The minimum sound insulation requirement for the ground floor, Level 1 and Level 2 amenity spaces is R'_w+C_{tr} 32 dB. This is on the basis that amplified sound will not be used in this space. The upper level amenity spaces shall be aligned with the requirements outlined in Table 13 (excluding low frequency facade sound insulation performance requirements) on the basis that amplified sound will not be used in the spaces.

If amplified sound is proposed, the operational noise egress assessment would need to be revised, and more onerous facade sound insulation performance requirements may be required.

8.3.2 Guidance on facade construction, glazing and ventilation strategy

The performance required by each element will depend on the relative areas of glazed and non-glazed elements.

The external wall construction will need to achieve a sound insulation performance of 10 dB higher than the glazing. For facade locations where there are specific low frequency sound insulation requirements the facade would need to incorporate either a pre-cast concrete element, masonry blockwork, or multiple layers of cement board.

Based on the proposed elevations, the glazed elements comprise approximately 40–50% of the overall facade construction.
REF _Ref223699499 \h Table 14sets out some examples of glazing configurations that could achieve the required sound insulation performances.

Table 14 Example glazing configurations

Minimum facade sound insulation performance	Example glazing configurations
R'_w+C_{tr} 30 R'_{63Hz} 18 dB R'_{63Hz} 14 dB	8 mm glass/16 mm cavity/6 mm glass
R'_w+C_{tr} 33 R'_{63Hz} 22 dB R'_{63Hz} 18 dB	8.8 mm acoustic laminate glass/16 mm cavity/10 mm glass
R'_w+C_{tr} 40 dB R'_{63Hz} 22 dB R'_{63Hz} 19 dB	To the north and west facades, the low frequency facade sound insulation requirements are onerous and the following are required: • Limited window size, approximately 2 m^2 (around 30% glazed area). • Wide space secondary glazing with a cavity of around 200 mm OR high performance double glazing configuration approximately 50 mm deep, with acoustic laminate glazing to both panes. • Consideration of glazing panel sizes as this will affect the low frequency sound insulation performance.

A more detailed facade assessment will be needed as the design develops to ensure the overall performance requirements are met.

All spaces are to be mechanically ventilated, with student accommodation ventilated via MVHR units. MVHR terminations will need to be suitably attenuated to ensure that noise ingress is adequately controlled.

Openable elements (ie, purge vents, windows) should not be relied upon to control overheating, but can be used for purge ventilation (eg, getting rid of odours).

9 Acoustics, ventilation and overheating

ADO2021 sets out requirements for internal noise levels in bedrooms during the night, and therefore takes precedence over AVO Guide. For living rooms during the day, the guidance in AVO Guide has been used to inform the recommendations provided.

9.1 Approved Document O 2021 (during the night)

Although demonstrating compliance with ADO2021 is not strictly a requirement of planning, achieving the requirements will likely have implications on the building's design. This may include impacts on the appearance of the facade and requirements for additional building

services plant (eg, external heat rejection plant, mechanical ventilation with/without cooling units within apartments).

ADO2021 sets out requirements for internal noise levels in bedrooms during the night, and therefore takes precedence over AVO Guide.

The *Approved Document O Noise Guide*, 2024 Association of Noise Consultants (ANC) provides the following simplified assessment method in relation to meeting the requirements of ADO:

> *'Based on typical assumptions, the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of AD-O are expected to be approximately 5 dB for 'high' risk locations and 10 dB for 'moderate' risk locations.'*

There are external noise level thresholds above which the simplified method cannot be used, which are presented in Table 15. Above these thresholds a dynamic thermal modelling exercise should be carried out.

Table 15 External noise levels above which the simplified method cannot be used

Parameter	High risk location	Moderate risk location
Free-field night-time ambient noise level, $L_{Aeq,8hr}$ (dB)	45	50
Free-field night-time maximum noise level more than 10 times a night, L_{AFmax} (dB)	60	65

The results of noise survey and environmental noise modelling exercise have been used to assess external noise levels at night. The free-field external noise levels at night can be summarised as follows:

- Facade facing Whitworth Street: L_{Aeq} 54-67 dB and L_{AFmax} 67-82 dB
- Facade the railway: L_{Aeq} 53-59 dB and L_{AFmax} 62-82 dB.

The proposed site is considered a high-risk location. When compared with the levels set out Table 15, the levels outside the bedroom windows at night are predicted to exceed the simplified method thresholds.

Therefore, open windows to bedrooms at night can likely not be relied upon as a method to remove excess heat, and the 'dynamic thermal modelling method' will need to be used to demonstrate compliance with the requirements of ADO2021.

9.2 Acoustics, ventilation and overheating assessment (during the day)

The results of noise survey and environmental noise modelling have been used to carry out a Level 1 assessment of noise ingress during an overheating condition for living rooms during the day in line with the external noise criteria set out in Table 2.

The Level 1 assessment indicates that the proposed development falls into the high-risk category and therefore a Level 2 assessment is recommended.

10 Vibration assessment

10.1 Tactile vibration

BS 6472 states that the assessment should be based on the axis along which the highest VDV is measured to. During the measurements the highest VDV was measured on the Z axis.

Published timetables indicate that approximately 21 trains pass the site per hour during the day. This will result in approximately 368 trains passing on the tracks between 07:00 – 23:00. At night, published timetables indicate that approximately 10 trains pass the site per hour. This will result in approximately 79 trains passing on the tracks between 23:00 – 07:00.

Based on published timetables, during the day, 37 freight trains pass the site, whilst during the night-time, 26 freight trains pass.

Based on the maximum vibration values from Table 3, and on the number of trains passing on the tracks between 07:00 – 23:00 and 23:00 – 07:00, the equivalent VDVs over a 16 hour day and an 8 hour night are given in Table 16.

Table 16 Calculated vibration dose values at position V1

Axis	Calculated VDVs ($m/s^{1.75}$)	
	Day (07:00–23:00)	Night (23:00–07:00)
X	0.003	0.003
Y	0.003	0.003
Z	0.019	0.016

These predicted equivalent VDVs, during the day and night periods are lower than the thresholds of the 'low probability of adverse comment' categories in Table 3. The predicted equivalent VDVs would be lower on upper floors, meeting the 'low probability of adverse comment' threshold.

Levels experienced may vary depending on the type of train and position of the future buildings. However, the majority of the calculated VDVs are below the lowest BS 6472 threshold, and a significant increase in the number of trains would be required for the threshold to be exceeded. Based on this, tactile vibration due to trains is unlikely to be problematic for this development.

10.2 Ground-borne noise ingress

Ground-borne noise within the proposed development was predicted using an empirical formula described in the ANC guidelines.

Predicted ground-borne noise levels from the vibration measurements at position V1 is presented in Table 17. Levels are presented in terms of L_{ASmax} as described in BS 6472.

The assessment is based on the following:

- The building is understood to comprise of a heavyweight construction (ie, steel and/or concrete frame) supported on piles
- It is assumed there will not be significant changes to the nearby railway lines in terms of arrangement, track, rolling stock or operation.
- The nearest residential apartment accommodation is at least 5 m from the nearest rail track (in plan view).
- The measured pile was exposed, and a capping slab was not present. Therefore, a correction has been calculated to account for the attenuation provided by the presence of a capping slab would apply. This equates to a 4 dB reduction in the resultant vibration level. The results are presented with and without the capping slab correction.

Table 17 Predicted re-radiated noise level based on existing pile construction

Level	Predicted ground-borne noise levels, L_{ASmax} (dB)			
	Exposed existing pile (without capping slab correction)		Exposed existing pile (with capping slab correction)	
	Freight	Passenger	Freight	Passenger
Ground	40	30-38	36	26-34
1	38	28-36	34	24-32
2	36	26-34	32	22-30
3	34	24-32	30	20-28
4	33	23-31	29	19-27
5	33	22-30	29	18-26
6	32	21-29	28	17-25

Level	Predicted ground-borne noise levels, L_{ASmax} (dB)			
	Exposed existing pile (without capping slab correction)		Exposed existing pile (with capping slab correction)	
	Freight	Passenger	Freight	Passenger
Ground	40	30-38	36	26-34
7	32	21-29	28	17-25
8 and above	≤32	≤28	≤28	≤25

Of the train passes captured during the survey period, all the predicted levels were lower than criteria proposed by MCC. The predicted values are for worst-case lower level apartments. Noise levels from this source are expected to be lower at upper floor levels.

11 Conclusion

The representative measured background sound levels were $L_{A90,15min}$ 54 dB during the day, and $L_{A90,15min}$ 47 dB during the night. Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises are $L_{Aeq,15min}$ 49 dB during the day, and $L_{Aeq,15min}$ 42 dB during the night. These have been corrected relative to the measured free-field background sound levels by the addition of 3 dB (as per the guidance provided in BS 8233:2014 Section G.2.1).

These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent.

An initial assessment has been carried out to determine required acoustic performances for the facades and provide guidance on the ventilation strategy. The required overall facade sound insulation performances range from R'_w+C_{tr} 24 dB to R'_w+C_{tr} 40 dB, with specific low frequency sound insulation performance requirements for spaces affected by entertainment noise ingress.

Open windows to bedrooms at night can likely not be relied upon as a method to remove excess heat, and the 'dynamic thermal modelling method' will need to be used to demonstrate compliance with the requirements of ADO2021.

For tactile vibration from the nearby railway, the predicted equivalent VDVs, during the day and night periods are lower than the thresholds of the BS 6472 'low probability of adverse comment' categories.

Of the train passes captured during the survey period, all the predicted ground-borne noise levels were lower than criteria proposed by MCC. The predicted values are for worst-case lower-level student accommodation. Noise levels from this source are expected to be lower at upper floor levels.

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Appendix A

Survey details

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Equipment

The unattended noise measurements were taken using a Svantek 307 sound level meter. The attended noise measurements were taken using a Rion NL-52 sound level meter, and a Brüel & Kjær 2250 sound level meter.

The VDV and one-third octave band RMS acceleration measurements were carried out using a Rion VM-56 vibration level meter.

Tri-axial acceleration measurements were carried out using a RionPV-83D accelerometer, a Rion VM-56 sound level meter and data recorder.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Unattended noise measurements				
Sound level meter	SV307/82059	Svantek	16 Mar 23	00001105-2b
Microphone	ST30/82581	Svantek	16 Mar 23	00001105-2b
Calibrator	SV36/76710	Svantek	16 Mar 23	00001105-2a
Attended noise measurements				
Sound level meter	2250/3011964	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Microphone	4189/3100176	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Pre-amp	ZC0032/26376	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Calibrator	4231/3019123	Brüel & Kjær	8 Sep 23	UCRT21/2086
Sound level meter	NL-52/00932326	Rion	16 Mar 23	TCRT21/1182
Microphone	UC-59/05549	Rion	16 Mar 23	TCRT21/1182
Pre-amp	NH-25/32354	Rion	16 Mar 23	TCRT21/1182
Calibrator	NC-74/34125432	Rion	16 Mar 23	TCRT21/1181

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Vibration measurements				
Data recorder	VM-56 / 34120180	Rion	24 Jun 26	TCRT24/1468
Accelerometer	PV-83D / 90183	Rion	24 Jun 26	TCRT24/1468
Vibration calibrator	VC-21 / 240408	MMF	29 May 26	0255 WK 2024-05

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{ASmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a slow time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures*.

Vibration indices

For each measurement period a number of parameters were recorded. The most relevant of these are described below:

- The vibration dose value (VDV) in each of three axes with the appropriate frequency weightings (as defined in BS 6472-1:2008). VDV combines the magnitude of vibration and the time for which it occurs. When assessing intermittent or time-

varying vibration it is necessary to use the Vibration Dose Value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period.

- The maximum RMS acceleration levels in each of three axes in one-third-octave bands, measured using the 'slow response' exponential time weighting.
- $L_{Amax,T}$ – The highest A-weighted sound pressure level measured in the period (T) with either fast (L_{AFmax}) or slow (L_{ASmax}) time weightings. When not weighted it is denoted L_{Fmax} or L_{Smax}.

Weather conditions

During the attended noise measurements, the weather was generally clear and dry and no rain occurred until 00:15 where measurements were finished. Wind speeds were measured at each position and varied between 2 m/s and 5 m/s.

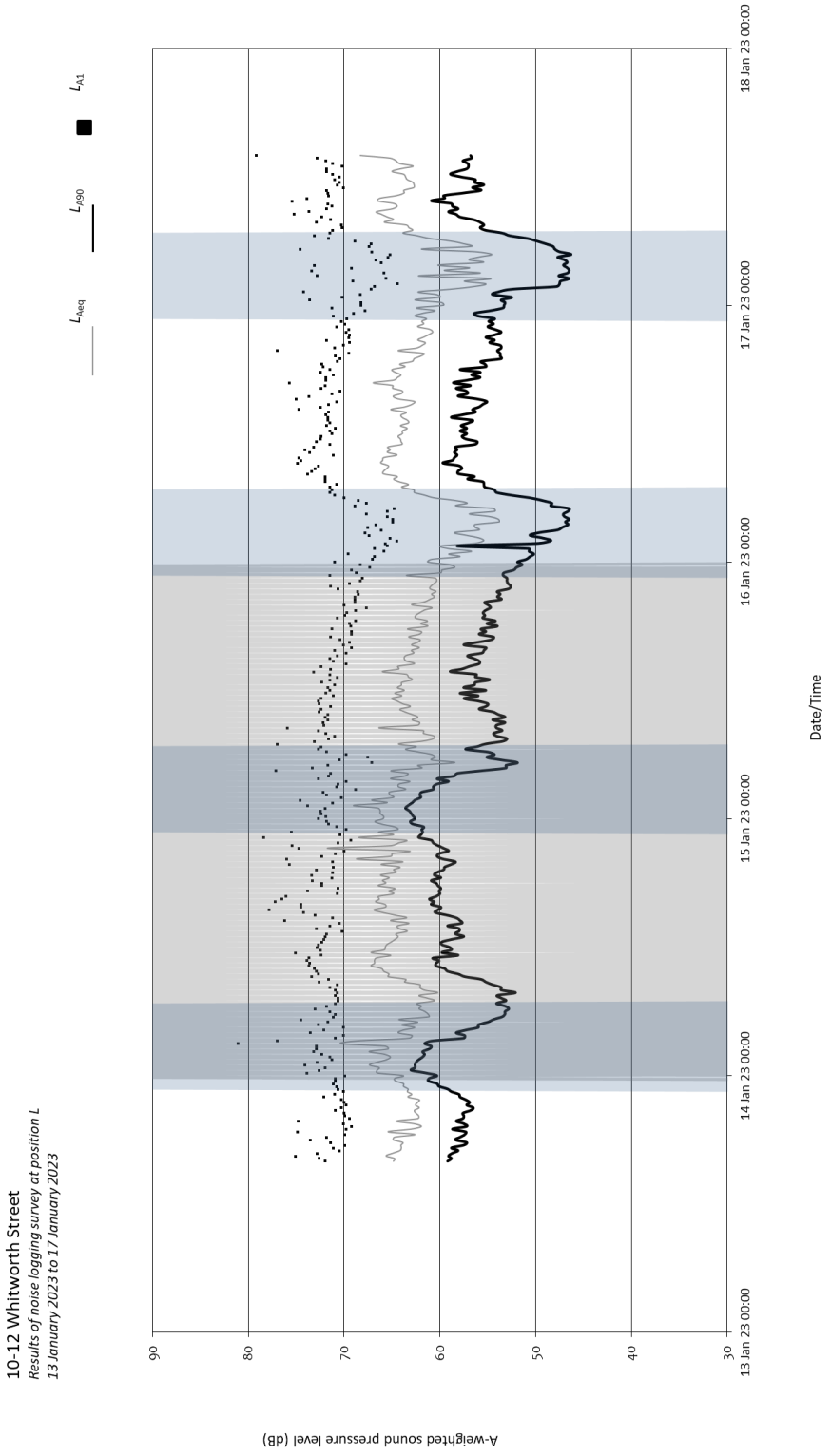
During the unattended noise measurements, weather reports for the area indicated that temperatures varied between -2°C at night and 9°C during the day, and the wind speed was less than 5 m/s (although gusts of up to 10 m/s were included in weather reports on 13 January 2023, measured wind levels throughout the day and night attended measurement periods did not reflect this).

These weather conditions are considered suitable for obtaining representative measurements.

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Appendix B

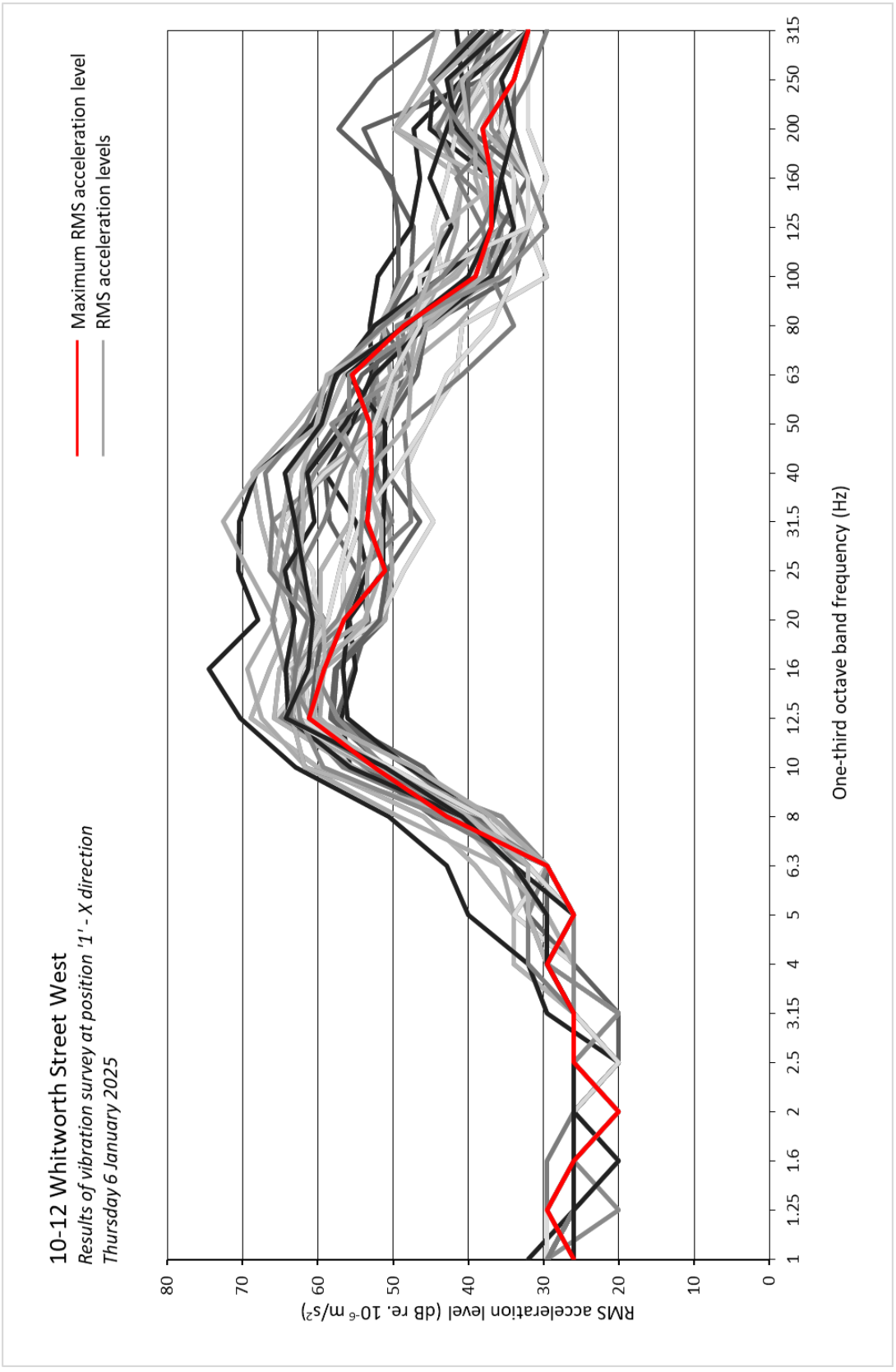
Results of unattended measurements at Position L

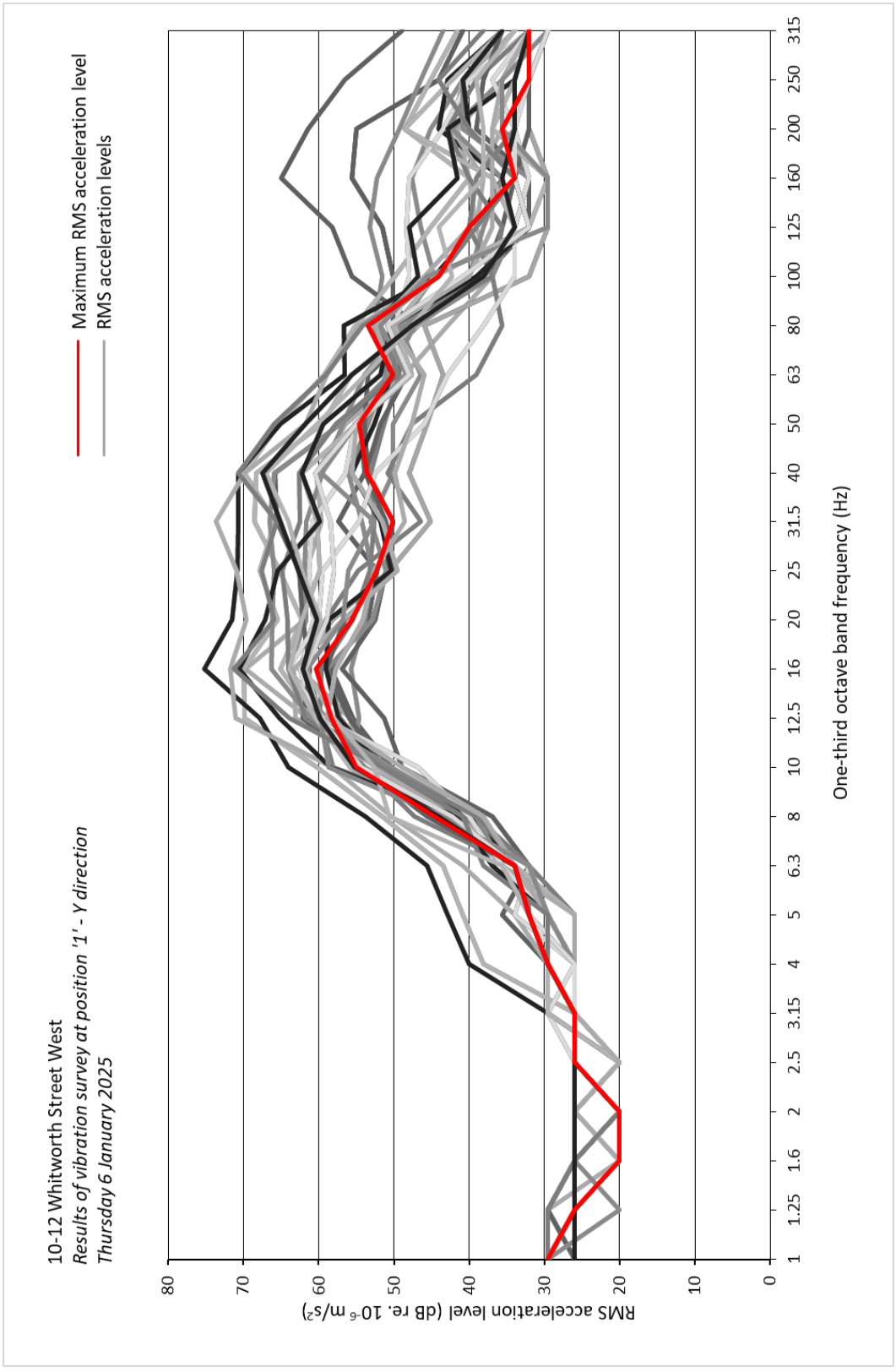

10-12 Whitworth Street
Results of noise logging survey at position L
13 January 2023 to 17 January 2023
L_{Aeq}
L_{A90}
L_{A1}
A-weighted sound pressure level (dB)
90
80
70
60
50
40
30
13 Jan 23 00:00
14 Jan 23 00:00
15 Jan 23 00:00
16 Jan 23 00:00
17 Jan 23 00:00
18 Jan 23 00:00
Date/Time

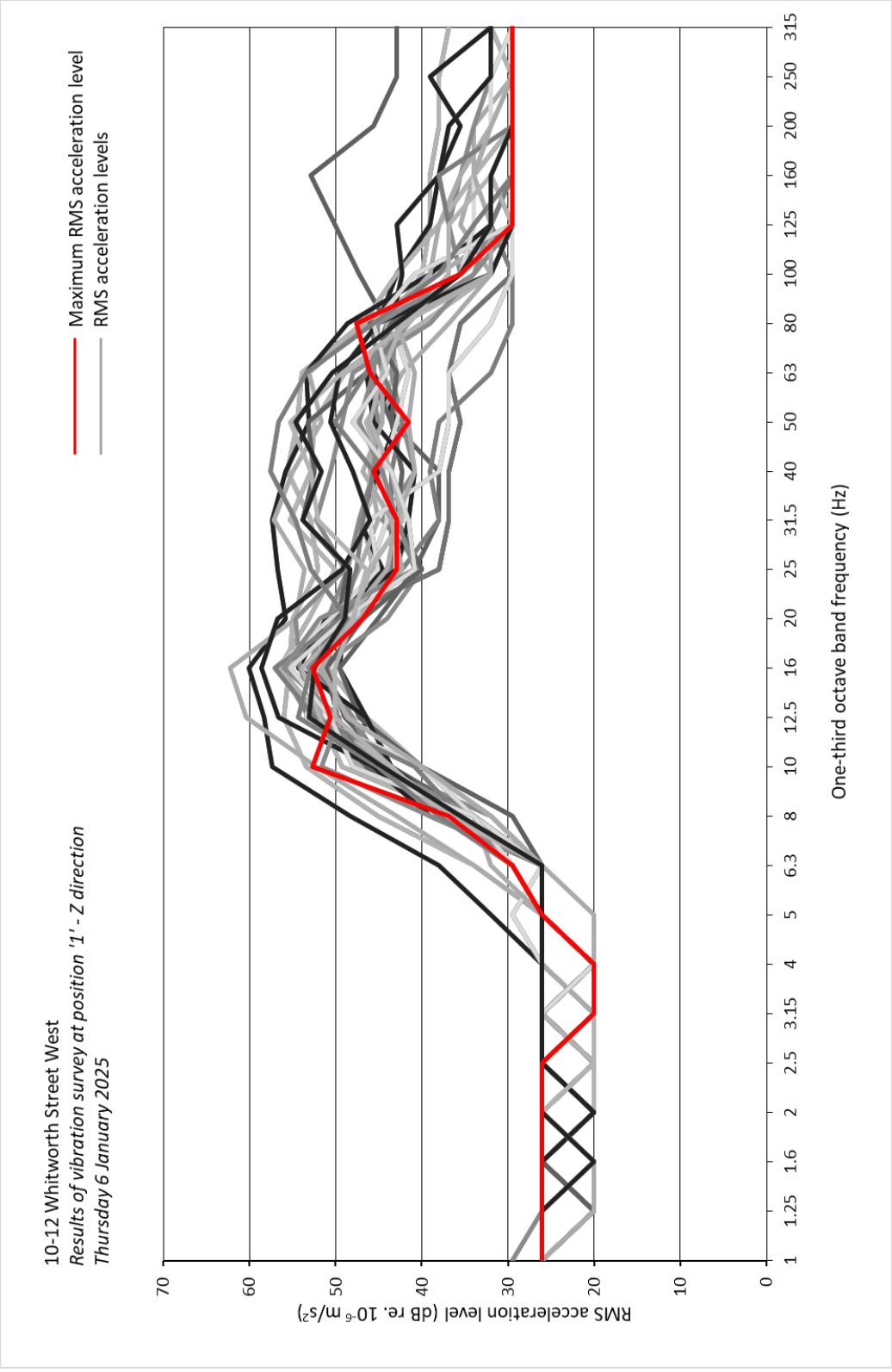
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Appendix C

Measurements of RMS vibration at position V1 (exposed existing pile)


10-12 Whitworth Street West
Results of vibration survey at position '1' - X direction
Thursday 6 January 2025
Maximum RMS acceleration level
RMS acceleration levels
RMS acceleration level (dB re. 10-6 m/s2)
0
10
20
30
40
50
60
70
80
1
1.25
1.6
2
2.5
3.15
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
One-third octave band frequency (Hz)

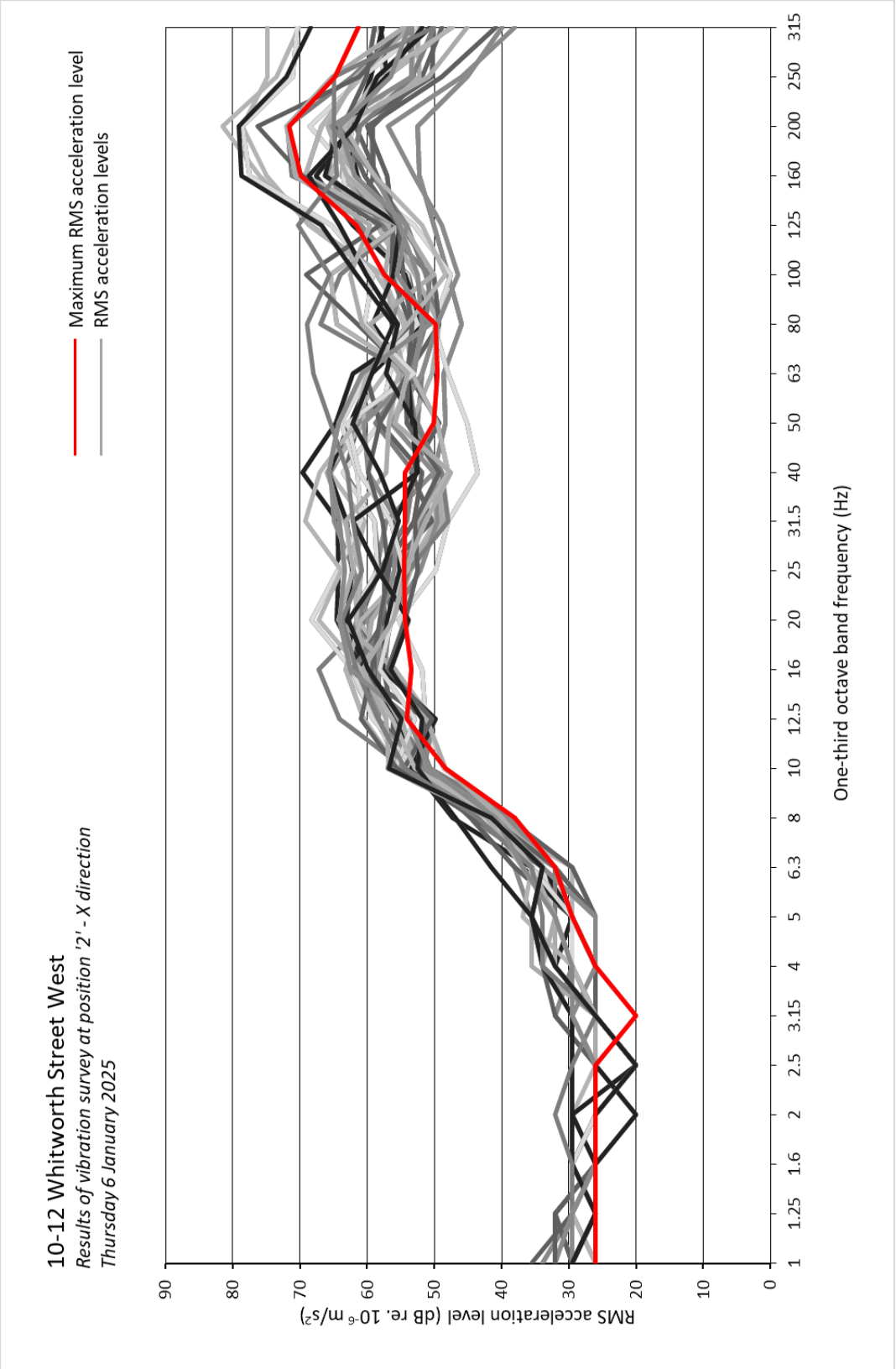

10-12 Whitworth Street West
Results of vibration survey at position '1' - Y direction
Thursday 6 January 2025
Maximum RMS acceleration level
RMS acceleration levels
RMS acceleration level (dB re. 10-6 m/s2)
One-third octave band frequency (Hz)
80
70
60
50
40
30
20
10
0
1
1.25
1.6
2
2.5
3.15
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315

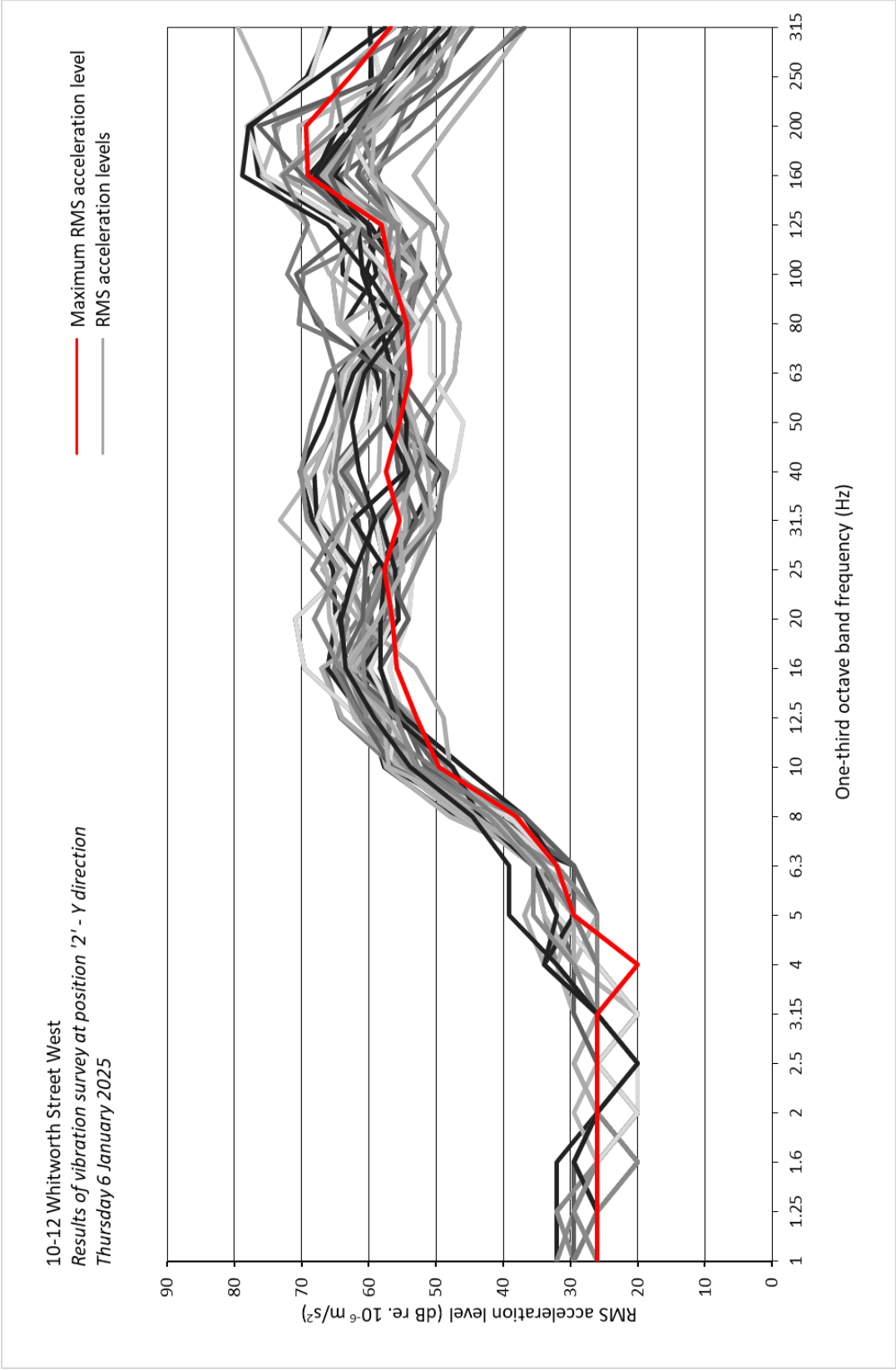

10-12 Whitworth Street West
Results of vibration survey at position '1' - Z direction
Thursday 6 January 2025
Maximum RMS acceleration level
RMS acceleration levels
RMS acceleration level (dB re. 10-6 m/s2)
70
60
50
40
30
20
10
0
One-third octave band frequency (Hz)
1
1.25
1.6
2
2.5
3.15
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315

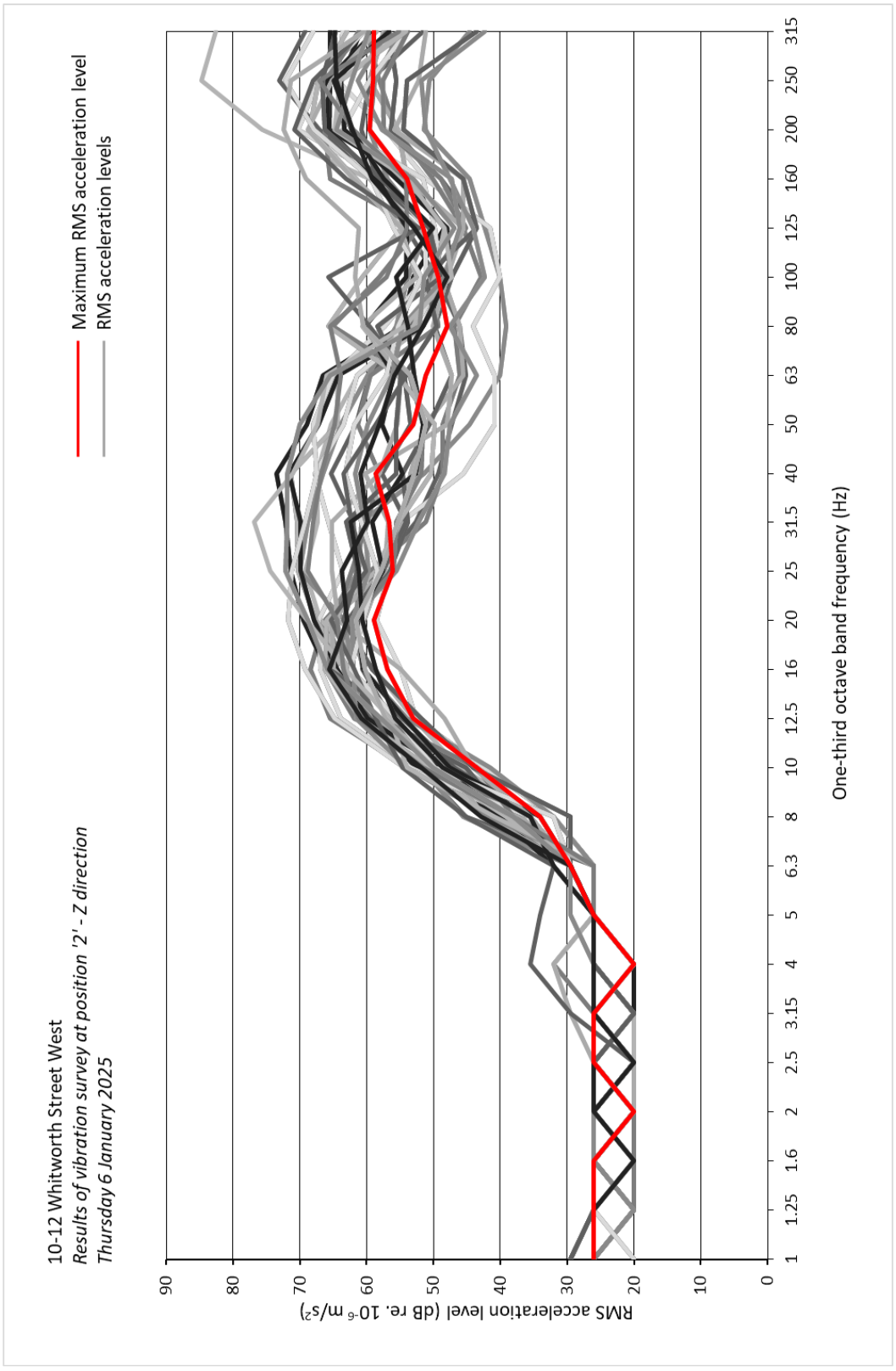
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Appendix D

Measured RMS acceleration results at position V2 (unmade ground)


10-12 Whitworth Street West
Results of vibration survey at position '2' - X direction
Thursday 6 January 2025
Maximum RMS acceleration level
RMS acceleration levels
RMS acceleration level (dB re. 10-6 m/s2)
90
80
70
60
50
40
30
20
10
0
1
1.25
1.6
2
2.5
3.15
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
One-third octave band frequency (Hz)


10-12 Whitworth Street West
Results of vibration survey at position '2' - Y direction
Thursday 6 January 2025
Maximum RMS acceleration level
RMS acceleration levels
RMS acceleration level (dB re. 10-6 m/s2)
90
80
70
60
50
40
30
20
10
0
1
1.25
1.6
2
2.5
3.15
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
One-third octave band frequency (Hz)


10-12 Whitworth Street West
Results of vibration survey at position '2' - Z direction
Thursday 6 January 2025
Maximum RMS acceleration level
RMS acceleration levels
RMS acceleration level (dB re. 10-6 m/s2)
One-third octave band frequency (Hz)
90
80
70
60
50
40
30
20
10
0
1
1.25
1.6
2
2.5
3.15
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315

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Appendix E

Predicted incident ambient noise levels

Predicted ambient noise levels during the day are set out in Table D1, and the predicted low frequency ambient noise levels are set out in Table D2.

Table D1 Predicted ambient noise levels

Floor level	Worst case ambient noise level, L_{Aeq} (dB) at each facade location			
	North	South	East	West
Ground	70	62	59	64
Level 1	70	62	61	63
Level 2	70	63	61	63
Level 3	69	63	61	63
Level 4	69	63	61	63
Level 5	68	62	62	63
Level 6	67	62	62	63
Level 7	67	62	63	63
Level 8	66	61	63	62
Level 9	65	61	64	62
Level 10	64	61	64	61
Level 11	64	61	64	61
Level 12	64	60	64	61
Level 13	63	60	64	61
Level 14	63	60	64	61
Level 15	63	60	64	61
Level 16	62	60	64	61
Level 17	62	60	63	61
Level 18	62	59	63	61
Level 19	61	59	63	61
Level 20	61	59	62	61
Level 21	61	59	62	61
Level 22	60	59	62	61
Level 23	60	59	62	60
Level 24	60	59	62	60
Level 25	60	58	62	60

Floor level	Worst case ambient noise level, L_{Aeq} (dB) at each facade location			
	North	South	East	West
Level 26	59	58	61	60
Level 27	59	58	61	60
Level 28	58	57	61	59
Level 29	58	57	60	59
Level 30	58	57	60	59
Level 31	58	57	60	59
Level 32	58	57	60	59
Level 33	58	56	60	58
Level 34	58	56	59	58
Level 35	58	56	59	58
Level 36	57	56	59	57
Level 37	57	56	58	57
Level 38	57	56	58	57

Table D2 Predicted low-frequency sound pressure levels at each facade location

Level	Predicted low frequency level at each facade location, L_{eq} (dB)			
	North facade		West facade	
	63 Hz	125 Hz	63 Hz	125 Hz
Ground	74	65	71	60
Level 1	73	64	70	59
Level 2	72	63	69	58
Level 3	72	63	69	58
Level 4	72	63	69	58
Level 5	71	62	69	58
Level 6	71	62	69	58
Level 7	71	62	69	58
Level 8	71	62	69	58
Level 9	70	61	69	58

Level	Predicted low frequency level at each facade location, L_{eq} (dB)			
	North facade		West facade	
	63 Hz	125 Hz	63 Hz	125 Hz
Level 10	70	61	68	57
Level 11	70	61	68	57
Level 12	70	61	68	57
Level 13	69	60	68	57
Level 14	69	60	67	56
Level 15	69	60	67	56
Level 16	69	60	67	56
Level 17	68	59	66	55
Level 18	68	59	66	55
Level 19	68	59	66	55
Level 20	67	58	66	55
Level 21	67	58	65	54
Level 22	67	58	65	54
Level 23	67	58	65	54
Level 24	66	57	65	54
Level 25	66	57	64	53
Level 26	67	58	66	55
Level 27	67	58	66	55
Level 28	66	57	65	54
Level 29	66	57	65	54
Level 30	66	57	65	54
Level 31	66	57	65	54
Level 32	66	57	65	54
Level 33	66	57	65	54
Level 34	66	57	65	54
Level 35	66	57	65	54
Level 36	65	56	64	53
Level 37	65	56	64	53

Level	Predicted low frequency level at each facade location, L_{eq} (dB)			
	North facade		West facade	
	63 Hz	125 Hz	63 Hz	125 Hz
Level 38	65	56	64	53

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Appendix F

Predicted maximum noise levels

Predicted maximum noise levels are set out in Table B3.

Table B3 Predicted maximum noise levels

Floor level	Maximum noise level, L_{Fmax} (dB) at each facade location			
	North	South	East	West
Ground	85	85	62	62
Level 1	85	85	62	62
Level 2	85	85	62	62
Level 3	85	85	62	62
Level 4	85	85	62	62
Level 5	85	84	62	62
Level 6	85	83	62	62
Level 7	84	83	61	61
Level 8	84	81	61	61
Level 9	83	80	61	61
Level 10	82	78	61	61
Level 11	82	78	61	61
Level 12	81	77	60	60
Level 13	80	76	60	60
Level 14	80	76	60	60
Level 15	79	75	60	60
Level 16	78	74	59	59
Level 17	78	73	59	59
Level 18	78	73	59	59
Level 19	77	72	59	59
Level 20	76	71	59	59
Level 21	76	71	59	59
Level 22	76	70	58	58
Level 23	75	69	58	58
Level 24	75	69	58	58
Level 25	74	69	58	58

Floor level	Maximum noise level, L_{Fmax} (dB) at each facade location			
	North	South	East	West
Level 26	74	68	58	58
Level 27	74	68	58	58
Level 28	74	68	58	58
Level 29	73	67	57	57
Level 30	73	67	56	56
Level 31	72	67	56	56
Level 32	72	67	56	56
Level 33	72	66	56	56
Level 34	71	66	56	56
Level 35	71	66	55	55
Level 36	70	65	55	55
Level 37	70	65	55	55
Level 38	70	65	55	55

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Appendix G

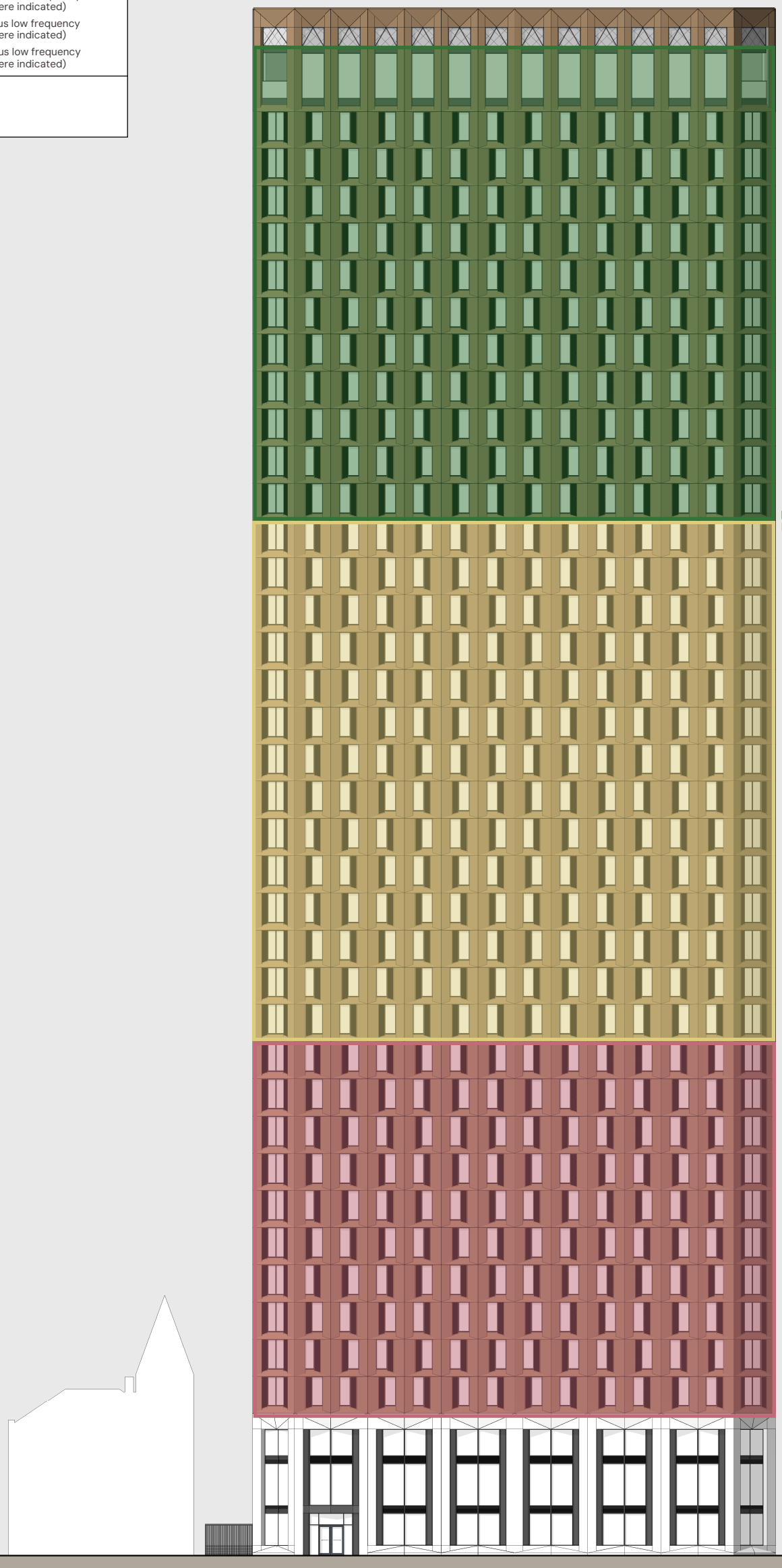
Minimum overall facade sound insulation performance requirements

Title	Minimum facade sound insulation requirements
Project	10-12 Whitworth Street
Project no.	025214
Version	D
Marked-up by	Matthew Robinson
Reviewed by	Mark Howarth
Date	28 April 2026

Mark-up key

- $R'_w + C_{tr}$ 40 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 33 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 30 dB (plus low frequency requirements where indicated)

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0 1.0 2.0 3.0 4.0 5.0 10.0m

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Rev.	Description	Date	Drawn	Chk.
02	Updated Issue	18.03.26	NI	NI
01	Draft Planning Issue	03.02.26	JP	NI

Client: Fusion Group

Project: Whitworth Street, Manchester

Drawing Title: Proposed North Elevation

Drawing Status: PLANNING

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Drawing No.	Revision
22987-CWA-XX-A-2101	02

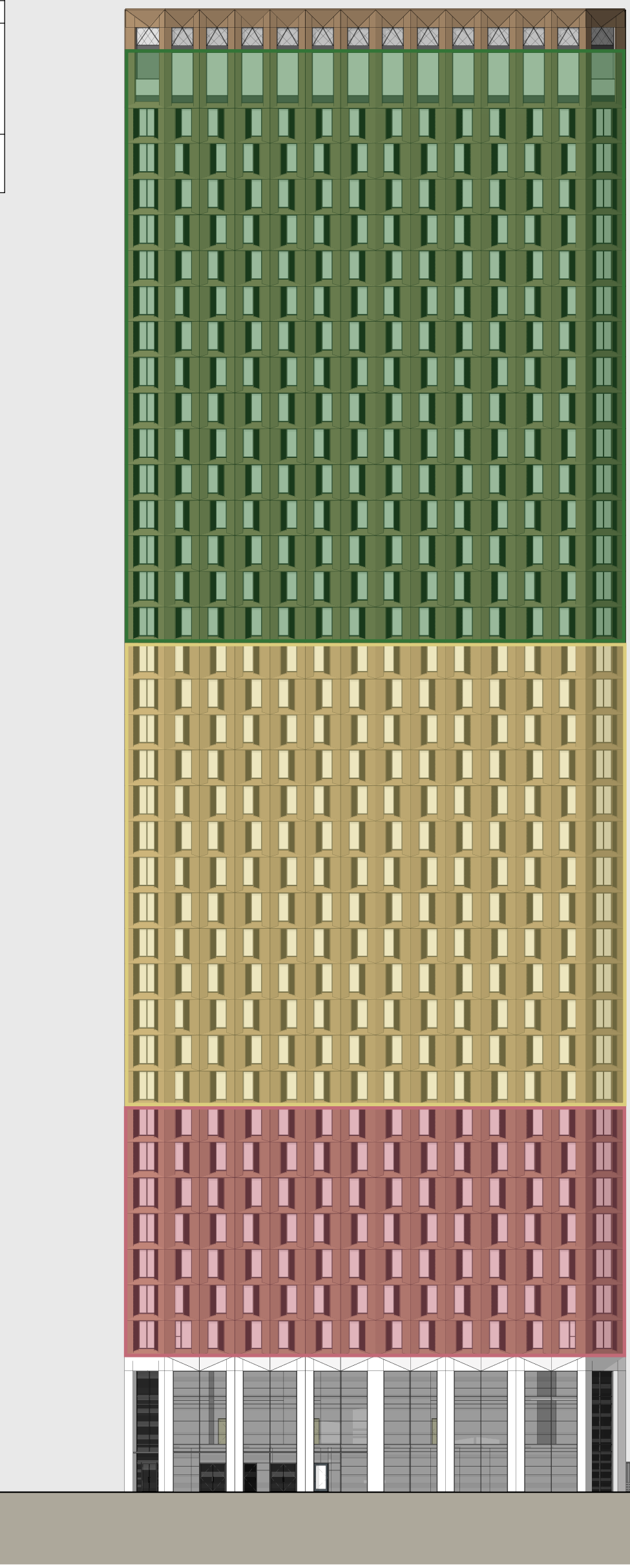
Drawn	Checked	Paper Size	Scale	Date
JP	AR	A1	1 : 200	02/02/26

Title	Minimum facade sound insulation requirements
Project	10-12 Whitworth Street
Project no.	025214
Version	D
Marked-up by	Matthew Robinson
Reviewed by	Mark Howarth
Date	28 April 2026

Mark-up key

- $R'_w + C_{tr}$ 40 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 33 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 30 dB (plus low frequency requirements where indicated)

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Rev.	Description	Date	Drawn	Chk.
02	Updated Issue	18.03.26	NI	NI
01	Draft Planning Issue	03.02.26	JP	NI

Client: Fusion Group

Project: Whitworth Street, Manchester

Drawing Title: Proposed South Elevation

Drawing Status: WIP

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Drawing No.	Revision
22987-CWA-XX-A-2102	02

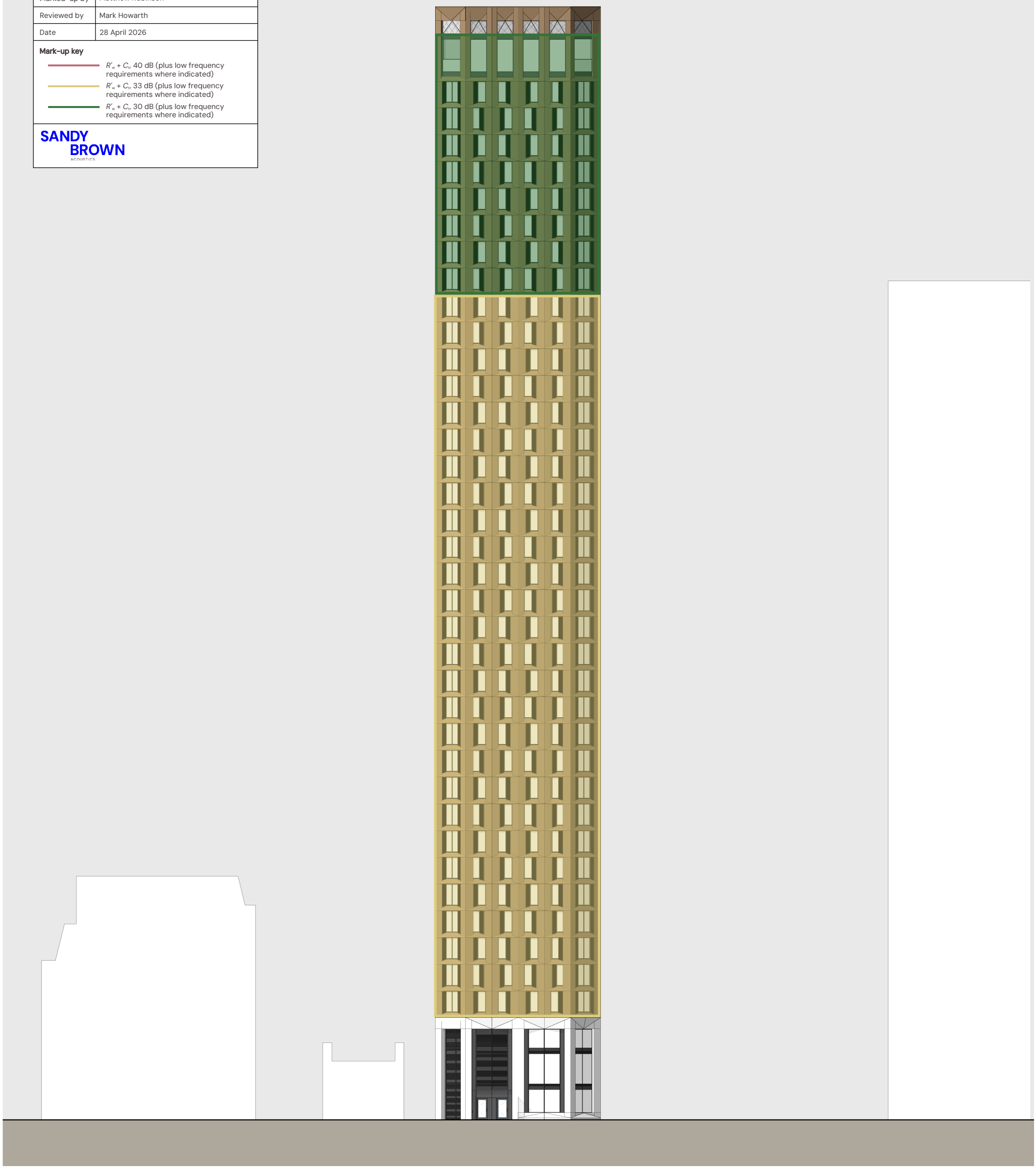
Drawn	Checked	Paper Size	Scale	Date
JP	AR	A1	1 : 200	02/02/26

Title	Minimum facade sound insulation requirements
Project	10-12 Whitworth Street
Project no.	025214
Version	D
Marked-up by	Matthew Robinson
Reviewed by	Mark Howarth
Date	28 April 2026

Mark-up key

- $R'_w + C_{tr}$ 40 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 33 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 30 dB (plus low frequency requirements where indicated)

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0 1.0 2.0 3.0 4.0 5.0 10.0m

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Rev.	Description	Date	Drawn	Chk.
02	Updated Issue	18.03.26	NI	NI
01	Draft Planning Issue	03.02.26	JP	NI

Client: Fusion Group

Project: Whitworth Street, Manchester

Drawing Title: Proposed East Elevation

Drawing Status: WIP

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Drawing No.	Revision
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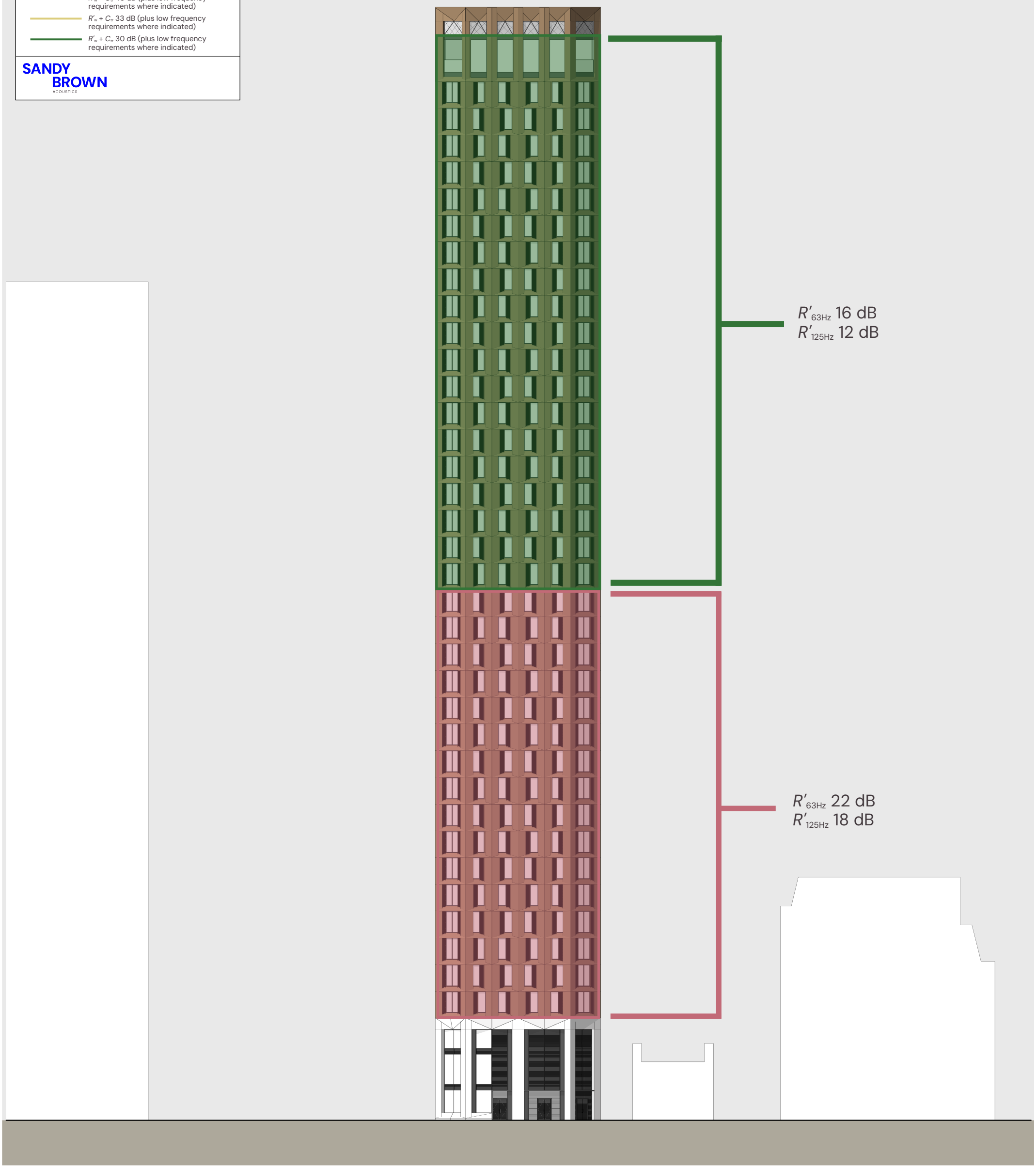
Drawn	Checked	Paper Size	Scale	Date
JP	AR	A1	1 : 200	02/02/26

Title	Minimum facade sound insulation requirements
Project	10-12 Whitworth Street
Project no.	025214
Version	D
Marked-up by	Matthew Robinson
Reviewed by	Mark Howarth
Date	28 April 2026

Mark-up key

- $R'_w + C_{tr}$ 40 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 33 dB (plus low frequency requirements where indicated)
- $R'_w + C_{tr}$ 30 dB (plus low frequency requirements where indicated)

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0 1.0 2.0 3.0 4.0 5.0 10.0m

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Rev.	Description	Date	Drawn	Chk.
02	Updated Issue	18.03.26	NI	NI
01	Draft Planning Issue	03.02.26	JP	NI

Client: Fusion Group

Project: Whitworth Street, Manchester

Drawing Title: Proposed West Elevation

Drawing Status: WIP

Corstorphine & Wright

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Drawing No.	Revision
22987-CWA-XX-A-2104	02

Drawn	Checked	Paper Size	Scale	Date
JP	AR	A1	1 : 200	02/02/26

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Appendix H

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

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