Appendix 14.1: Noise impact assessment supporting the planning application

1.1 The noise assessment prepared to support the planning application for the development is provided in the following pages.

Weston Halls and Pendulum Hotel

Noise impact assessment

12783.1003E

Revision	Description	Issued by	Date
A	First issue	BP	31 Oct 25
B	Minor amendments to scheme description, inclusion of retained NSL within the site	BP	19 Nov 25
C	Amended site name and description of noise receivers	BP	28 Nov 25
D	Redline boundary amended	BP	9 Dec 25
E	Development description amended	BP	9 Dec 25

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1 Summary

1.1 This report has been prepared in support of a planning application for a purpose built student accommodation development at the site of the existing Weston Halls and Pendulum Hotel, Sackville Street, Manchester.

1.2 The development consists of a total of 2,511 student bedrooms and associated amenity and ancillary spaces. The site will be developed in two phases, Phase A and Phase B.

1.3 Noise levels affecting the proposed development from road and rail traffic have been measured during the day and night, and noise levels across the site and proposed building façades have been calculated using environmental noise modelling software.

1.4 The main noise sources affecting the development are road traffic on the surrounding roads, rail movements across the viaduct to the north of the site and entertainment noise from the venues to the north-west of the site.

1.5 Existing environmental sound levels have been measured and sound levels have been modelled across the development site.

1.6 A site walk-around was conducted to identify any existing mechanical plant affecting the development. The only item of plant with noise emissions dominating the existing sound environment at the proposed site was identified as a kitchen extract fan associated with the Pendulum Hotel, which will be removed before the construction of Phase A of the development.

1.7 The upper floors of the proposed buildings will overlook mechanical plant on the roof of the Manchester Institute of Biotechnology to the south of the site. Noise from this equipment is not anticipated to be dominant or particularly distinctive at the proposed building façades. The minimum façade sound insulation requirements for façades overlooking the plant include an allowance for noise from the plant.

1.8 Student accommodation development will be mechanically ventilated, so windows are assumed to be closed for the purposes of the internal noise level assessment. The overheating mitigation strategy for the development enables purge panels to be closed during the night-time period.

1.9 Minimum façade sound insulation specifications to achieve Manchester City Council's internal noise level criteria in student bedrooms are presented in this report. These specifications address transport noise, music noise from nearby entertainment venues and existing sources of mechanical plant noise. The sound insulation of opaque portions of the façade should be reviewed as the design develops.

1.10 The façade sound insulation strategy for Phase A does not include the effect of noise screening by the future Phase B buildings. Future demolition plans for the Charles Street car park and the Faraday building are also considered in the calculations of façade noise levels.

1.11 Noise levels are predicted to be below 55 dB $L_{Aeq,\,16\,hr}$ in the majority of the external amenity space designated for exclusive student use. The site layout is well designed to screen external amenity areas from rail noise and road noise from Charles Street and Sackville Street.

1.12 The locations of noise and vibration generating amenity spaces in the development have yet to be determined. The gym should be located on a ground-bearing slab if possible and high-noise spaces should be separated as far as practicable from student bedrooms.

1.13 Preliminary assessments of music noise break-out to off-site noise-sensitive locations and internal sound transfer to sensitive spaces in the development have been carried out to demonstrate that the relevant MCC criteria for music noise can be achieved.

1.14 Detailed assessments of airborne and impact noise from the proposed gym, cinema, karaoke room and other high-noise spaces in the development should be carried out once locations of the proposed amenity spaces are finalised and the design has further developed. The following should be reviewed:

- Minimum façade sound insulation requirements for amenity spaces
- Build ups of separating elements between high-noise and sensitive spaces, along with junction detailing and treatment of potential flanking pathways
- Gym floor construction to control impact sound transfer, informed by subjective on-site testing of various floor types if practicable.

1.15 iQ Student Accommodation will manage the whole building, so any complaints from residents will be addressed internally in the first instance. This situation is considered to reduce the risk of ongoing noise issues associated with amenity spaces, since iQ will have the ability to manage the activities if necessary.

1.16 Limits for fixed mechanical plant associated with the development have been specified based on measurements of the background sound level and guidance in BS 4142. Noise emissions from the development should be assessed in detail once the mechanical design has been developed.

1.17 Based on the details outlined in this report, the noise risks identified are mitigated and minimised, and the site is considered suitable for the proposed purpose built student accommodation development.

2 Introduction

2.1 A student residential development is proposed at the existing Weston Halls and Pendulum Hotel site, Sackville Street, Manchester. The development consists of a total of 2,511 bedrooms, amenity spaces including a gym and karaoke rooms, and ancillary spaces, along with landscaped external areas.

2.2 The site will be developed in two phases, Phase A and Phase B, which will comprise:

- Phase A: Partial removal of existing structures and erection of two buildings comprising purpose-built student accommodation (sui generis), one of 50 storeys and one of 17 storeys with an 8-storey link, together with associated amenity space, external landscaping, highways works, and change of use of the Pendulum Hotel to purpose-built student accommodation, and
- Phase B: (b) Removal of remaining existing structures and erection of two buildings comprising purpose-built student accommodation (sui generis), one of 33 storeys and one of part-24 and part-8 storeys with a 1-storey link, together with associated amenity space, external landscaping, and highways works.

2.3 The site is bounded by Charles Street to the north, Sackville Street to the east, an existing raised terrace associated with university buildings to the south, and a hotel and university car park to the west.

2.4 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the potential noise impact on the proposed development site and of noise generated by the development on nearby noise-sensitive locations (NSLs), in support of a planning application.

2.5 The primary environmental noise sources considered in this assessment are:

- Rail movements across the Manchester and Altrincham Railway Viaduct running east-west to the north of the site
- Road traffic noise on the surrounding roads, including Charles Street, Sackville Street, Princess Street (A34) to the west, the A57(M) to the south and the A6 at greater distance to the east.
- Entertainment venues to the north-west of the site, including Joshua Brooks, Yes, Lass O'Gowrie, The Factory and The Garrett.

2.6 The nearest noise-sensitive locations to the site are identified as:

- NSL 1 – The Ibis hotel to the west of the site
- NSL 2 – The residential buildings on Granby Row to the north of the site
- NSL 3 – The residential buildings on Princess Street to the west of the site.
- NSL 4 – The existing student accommodation and nursery within the site that will remain in-situ during the demolition and construction of Phase A.

2.7 The site location and nearest NSLs outside of the site boundary are shown in Figure 1.

2.8 The purpose of this report is to identify appropriate acoustic design parameters and the manner in which these may be achieved in practice.

2.9 The scope of our appointment includes:

- Measurements of the existing noise environment
- Model noise based on the proposed layouts to determine noise levels impacting across the site
- Provide a detailed scheme for the mitigation of environmental noise impacts on the proposed development, including building envelope sound insulation requirements and a review of the proposed ventilation strategy
- Assess airborne and impact noise generated within proposed amenity spaces, both at the nearest off-site noise-sensitive locations and within student bedrooms in the proposed buildings, and
- Identify nearby noise-sensitive locations to the development and set limits for building services noise emissions.

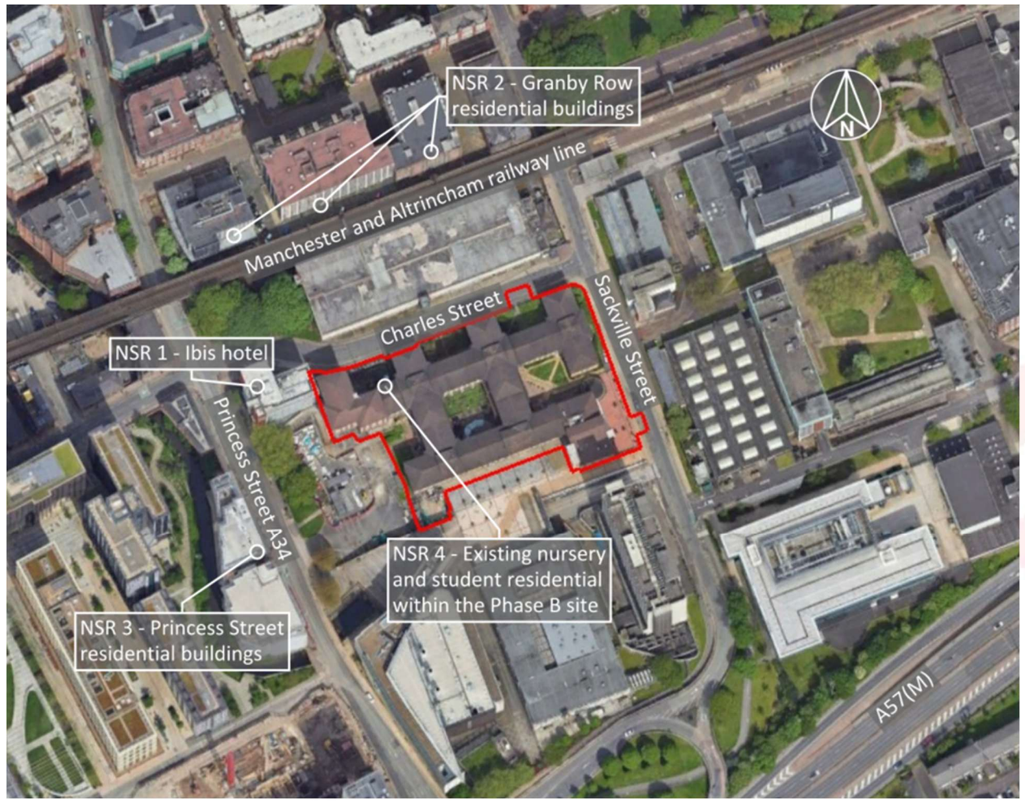


Figure 1: Site location outlined in red, nearest NSLs indicated

3 Planning policy and noise criteria

3.1 National Planning Policy Framework (NPPF)

3.2 The National Planning Policy Framework (NPPF) Reference 1, sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. In respect of noise, Paragraph 187, 198 and 200 of the NPPF states the following:

3.3 Paragraph 187:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability…"

3.4 Paragraph 198:

"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:

a) 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[65 [See Explanatory Note to the Noise Policy Statement for England];

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

3.5 Paragraph 200:

"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. "

3.6 **Noise Policy Statement for England (NPSE)**

3.7 The Noise Policy Statement for England, Reference 2, states three policy aims 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."

3.8 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
  This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- Lowest Observed Adverse Effect Level (LOAEL)
  This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
  This is the level above which significant adverse effects on health and quality of life occur

3.9 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.10 **Manchester City Council guidance**

3.11 Policies on noise from the Manchester Core Strategy Development Plan Document, Reference 3, are summarised below.

3.12 The portions of Policy DM1 Development Management relating to noise are as follows:

"All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:

- Effects on amenity, including … noise, vibration, ... This could also include proposals which would be sensitive to existing environmental conditions, such as noise…
- Design for health
- Adequacy of internal accommodation and external amenity space…"

3.13 Some policies from the superseded Unitary Development Plan have been retained, including Citywide Development Control Policy 26 Development and Noise, which states:

"DC26.1 The Council intends to use the development control process to reduce the impact of noise on people living and working in, or visiting, the City. In giving effect to this intention, the Council will consider both:

a) the effect of new development proposals which are likely to be generators of noise; and

b) the implications of new development being exposed to existing noise sources which are effectively outside planning control.

DC26.2 New noise-sensitive developments (including large-scale changes of use of existing land or buildings), such as housing, schools, hospitals or similar activities, will be permitted subject to their not being in locations which would expose them to high noise levels from existing uses or operations, unless the effects of the noise can realistically be reduced. In giving effect to this policy, the Council will take account both of noise exposure at the time of receiving a planning application and of any increase that may reasonably be expected in the foreseeable future.

DC26.3 Developments likely to result in unacceptably high levels of noises will not be permitted:

a) in residential areas;

b) near schools, hospitals, nursing homes and similar institutions; and

c) near open land used frequently for recreational purposes.

DC26.4 Where the Council believes that an existing noise source might result in an adverse impact upon a proposed new development, or where a new proposal might generate potentially unacceptable levels of noise, it will in either case require the applicant to provide an assessment of the likely impact and of the measures he proposes to deal satisfactorily with it. Such measures might include the following:

a) engineering solutions, including reduction of noise at source, improving sound insulation of sensitive buildings or screening by purpose-built barriers;

b) layout solutions, including consideration of the distance between the source of the noise and the buildings or land affected by it and screening by natural barriers or other buildings or noncritical rooms within a building; and

c) administrative steps, including limiting the operating times of the noise source, restricting activities allowed on the site or specifying an acceptable noise limit. Any or all of these factors will be considered appropriate for inclusion in conditions on any planning permission.

DC26.5 The Council will control noise levels by requiring, where necessary, high levels of noise insulation in new development as well as noise barriers where this is appropriate.

DC26.6 Exceptions to the general policy will be considered on their merits. The Council accept, as an example, that the occasional use of outdoor facilities such as sports stadia for concerts can be acceptable in certain circumstances. Any such proposal will be considered in the light of consultation with local residents and others, and the practicability of appropriate conditions on any approval."

3.14 Manchester City Council Planning and Noise Technical Guidance, Reference 4, provides additional guidance on how national and local planning policy aims will be applied in practice. The guidance document states:

"In the context of government policy, the Council require that developments aim for:

1. A noise level between the 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) and the 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). Conditions may be attached.

If point 1 cannot be achieved, then:

2. If the assessment results in a level between the Lowest Observed Adverse Effect Level and the Significant Observed Adverse Effect Level (this is the level of noise exposure above which significant adverse effects on health and quality of life occur), mitigation will be necessary to reduce the level and thus conditions will be attached.

If points 1 & 2 cannot be achieved, then:

3. If the assessment results in a Significant Observed Adverse Effect Level after mitigation, the application will be recommended for refusal."

3.15 The Technical Guidance Note provides noise limits to align with the aims of point 1. Relevant criteria are outlined below.

3.16 *Residential developments*

"The Council has adopted the following noise limits for residential properties:

- Bedrooms (night time - 23.00 - 07.00) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 10 times)
- Living Rooms (daytime - 07.00 - 23.00) 35 dB L_{Aeq}
- Gardens and terraces (daytime) 55 dB L_{Aeq}

3.17 These criteria align with those in Professional Practice Guidance on Planning & Noise: New Residential Development (ProPG), Reference 5.

3.18 *Entertainment uses*

3.19 MCC criteria for entertainment uses are considered to apply to proposed karaoke room and music noise from the proposed gym.

3.20 Within off-site noise-sensitive buildings where the amenity space is not structurally attached, music noise from the proposal should not be 'audible', assuming that the residential properties in question have their windows open. The following criterion applies:

"Entertainment noise ($L_{Aeq,5min}$) should be controlled to 5dB below the typical background noise level (L_{A90}) in each octave band at the nearest noise sensitive location".

3.21 Within residential spaces in the same building, i.e. Studios, Twodios and Cluster Flats, the guidance requires a condition of 'inaudible' / 'virtually inaudible' and provides the following quantitative limits:

"Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB ($L_{eq,5min}$), respectively."

3.22 These absolute limits for entertainment noise are also adopted to assess the potential impact of existing music noise from the nightlife venues to the north-west of the site within proposed student bedrooms.

3.23 *Noise and vibration from fixed plant / equipment*

3.24 The following limits are specified at the nearest noise-sensitive locations to the site when assessed in accordance with BS 4142, Reference 6:

"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."

3.25 We have confirmed with a representative of Manchester City Council environmental health department that the criteria in the technical guidance document will be adopted, and additionally agreed to consider the ProPG Gym Acoustics Guidance document, Reference 7, with respect to impact sound from the proposed gym.

3.26 *Gym impact sound*

3.27 The ProPG Gym Acoustics Guidance document provides indicative criteria for heavy impact sound in various room uses, based on 'G curves', a single-figure weighting method proposed in the guide based on the curves shown in Figure 2.

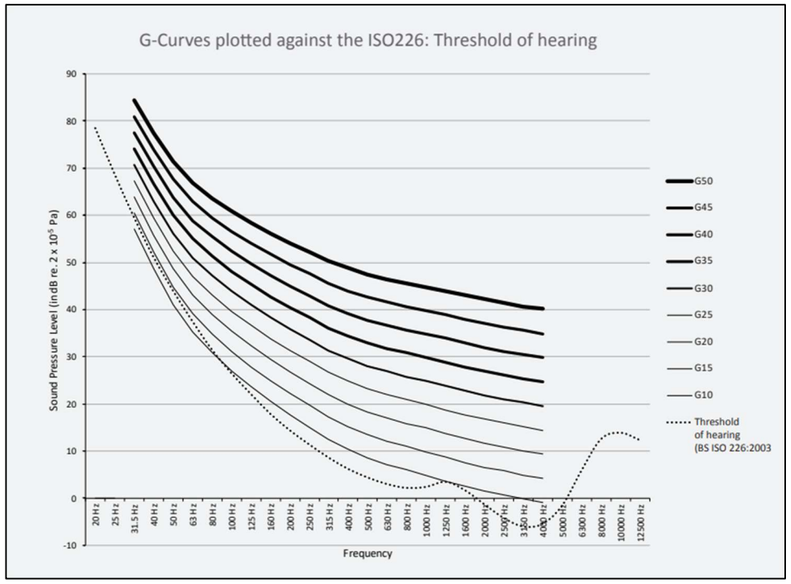


Figure 2: G-curves from Gym Acoustic Guidance

3.28 In residential areas, the Gym Guide proposes a range of G20-25 for the daytime and G15-20 during the night-time. Since residential areas in the development will be mechanically ventilated, and will therefore benefit from a constant low level of masking noise, we have adopted an indicative criterion for heavy impact noise of ≤ G20 L_{AFmax} (31.5 Hz-8kHz), day and night.

3.29 This indicative criterion is proposed to assist with the design process; however, we anticipate that selection of gym floor finishes and commissioning will be based on subjective acceptability.

3.30 iQ Student Accommodation will manage the whole building, so any complaints from residents will be addressed internally in the first instance. This situation is considered to reduce the risk of ongoing noise issues associated with the gym, since iQ will have the ability to manage gym activities if necessary.

3.31 If re-radiated noise from heavy impacts is suitably controlled, tactile vibration is typically not problematic, so no specific vibration criteria are proposed.

3.32 **Professional Practice Guidance on Planning & Noise**

3.33 Professional Practice Guidance on Planning & Noise: New Residential Development (ProPG), is a guidance document on the management of noise within the planning system in England for new build housing developments.

3.34 The document draws together guideline limits for internal noise levels from external transport sources from other sources of guidance, including BS 8233, Reference 8, and the World Health Organisation (WHO) Guidelines for Community Noise, Reference 9.

3.35 These criteria are consistent with those in Manchester Council's Planning and Noise Technical Guidance, and are presented in Table 1.

Activity	Location	Guideline upper limit, dB		
		$L_{Aeq,\ daytime}$	$L_{Aeq,\ night\text{-}time}$	L_{AFmax}
Resting	Living room	35	-	-
Dining	Dining room	40	-	-
Sleeping (daytime resting)	Bedroom	35	30	45

Table 1: ProPG internal noise level requirements

3.36 The daytime period is defined as the 16 hours between 07:00 to 23:00 hours and the night-time period is defined as the 8 hours between 23:00 to 07:00 hours.

3.37 With regards to the night-time L_{AFmax} criterion, ProPG states:

"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 45 dB $L_{Amax,F}$ more than 10 times a night."

3.38 It is considered that the adopted internal ambient noise level targets align with the LOAEL following the terminology of the NPSE, such that meeting these targets adequately achieves the aims of the NPPF and NPSE.

3.39 ProPG guidance on external amenity area assessments "reflects and extends the advice contained in BS 8233:2014 and the current Government guidance in PPG-Noise". Relevant guidance from these sources is summarised in the document as follows:

- "If external spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended."
- "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50-55 dB $L_{Aeq,\ 16\ hr}$."
- "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces."

3.40 **BS 4142**

3.41 BS 4142 provides methods for assessing industrial and commercial sound. This is the appropriate methodology for assessing sound from mechanical plant associated with the development.

3.42 The BS 4142 assessment methodology can be summarised as follows:

- Determine the specific sound level at the assessment location by measurement or calculation, accounting for source 'on-time' if necessary.
- Determine a representative background sound level based on measurements at the noise-sensitive location, or at a suitable alternative location with appropriate justification where this is not possible.
- Calculate the rating level from the specific sound level by adding character corrections for distinctive features of the sound.
- Estimate the noise impact by subtracting the background sound level from the rating level.
- Consider all relevant contextual factors such as the character and level of the sound source and prevailing sound environment to reach a final assessment of the impacts.

3.43 The results of the initial estimate of impact of the assessed sound source is based on the following from section 11 of BS 4142:

- Typically, the greater the difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant 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, depending on the context.

3.44 Given that plant such as smoke extract fans and backup generators will only operate in emergency conditions or periodically for short periods of testing, we consider that a more relaxed noise limit is appropriate compared with plant that runs during normal operation. We propose that the rating level of noise from emergency plant should not exceed a level more than 5 dB over the representative background sound level at the nearest NSLs.

3.45 **Summary of adopted noise criteria**

3.46 Environmental noise break-in to studios, twodios and cluster bedrooms should not exceed:

- Daytime 35 dB $L_{Aeq,\ 16\ hr}$
- Night-time 30 dB $L_{Aeq,\ 8\ hr}$, and
  45 dB L_{AFmax} not normally exceeded more than 10 times per night
- Existing music noise sources: 47 dB $L_{eq,\ 5\ min}$ at 63 Hz
  41 dB $L_{eq,\ 5\ min}$ at 125 Hz.

3.47 Noise levels in external amenity spaces should not exceed 55 dB $L_{Aeq,\ 16\ hr,\ where\ practicable.}$

3.48 Criteria for noise generated by the development are presented in Table 2.

Sound source	Location	Criterion
Fixed mechanical plant during normal operation	Off-site noise-sensitive locations	Rating level at least 5 dB below the background sound level
Fixed mechanical plant during emergency operation and testing	Off-site noise-sensitive locations	Rating level no more than 5 dB above the background sound level
Entertainment noise from amenity spaces (e.g. karaoke rooms, gym music noise)	Off-site noise-sensitive locations	5dB below the typical background sound level in each octave band
	Within habitable rooms in the development	≤ 47 dB $L_{eq,\ 5\ min}$ at 63 Hz ≤ 41 dB $L_{eq,\ 5\ min}$ at 125 Hz
Gym heavy impact sound	Within habitable rooms in the development	≤ G20 L_{Fmax} (31.5 Hz-8kHz)[1]
[1] Indicative criterion to assist with design. Final acceptability to be based on subjective audibility		

Table 2: Criteria for noise generated by the development

4 Noise sources and measurements

4.1 Measurements of the existing sound environment have been carried out to determine sound levels impacting the site.

4.2 The survey positions and durations are summarised in Table 3 and indicated with markers on the map in Figure 3. Table 3 also indicates the purpose of the measurement and the main sound sources noted.

4.3 The selected positions are either close to the surrounding roads and railway to isolate noise emissions from these sources for inclusion in a computer noise model, or are representative of the proposed building location. This approach has been agreed with a representative of Manchester Council environmental health department.

4.4 In addition to the measurements described in Table 3, short-term measurements were carried out at the north and east façades of the existing Weston Halls building and on the raised terrace to the south of the site to assist with calibration of the noise model.

4.5 Guidance from BS 7445, Reference 10, Calculation of Railway Noise, Reference 11, and the shortened measurement procedure outlined in paragraph 43 of Calculation of Road Traffic Noise (CRTN), Reference 12 has been considered.

4.6 The equipment used is listed in Appendix A.

4.7 All sound level meters and calibrators used meet the technical specifications of BS 7445 and have current calibration certificates traceable to national standards. The equipment was field-calibrated before and after the measurement with no significant drift in sensitivity noted.

4.8 Weather conditions were dry with wind speeds below 5 m/s.

Position ID	Purpose of survey location	Measurement dates / duration	Notes on microphone position	Main sound sources
L1	To capture road traffic noise from the A57(M)	Between 14:35 on Friday 10 October and 14:58 on Tuesday 14 October 2025	Microphone 3m above ground in free-field conditions	Road traffic on the A57
L2	To capture railway noise Position considered to be representative of the background sound environment at NSL 2 and the parts of the existing student accommodation within Phase B most screened from environmental noise	Between 17:05 on Friday 10 October and 14:08 on Tuesday 14 October 2025	Microphone approximately 7 m above ground, just above parapet level of the railway viaduct. Measurements are treated as free-field as the walls of the car park are open. Reflections from the internal floor and soffit of the car park may marginally increase the measured level from other sources, such as road traffic on Charles Street; however, this is unlikely to significantly affect the measured levels.	Train passes on the viaduct. Road traffic on Sackville Street and Charles Street, activity in the nursery school playground on Charles Street and intermittent activity in the multi-storey car park to the north also contributed to the measured level.
L3	To capture road traffic noise from Princess Street (A34) Position considered to be representative of the background sound environment at NSLs 1 and 3	Between 19:11 on Friday 10 October and 14:36 on Tuesday 14 October 2025	Microphone approximately 3 m above ground and 2 m from the building façade, so the measurements are considered to be façade levels.	Road traffic noise from Princess Street was generally dominant. Road traffic on the A57 was audible in gaps between traffic. Patron noise, particularly the queue for entry to The Factory, was the dominant source at times on Friday and Saturday nights. Position LT-3 was screened from noise from the kitchen extract associated with the Pendulum Hotel.
L4	To capture road traffic noise from Sackville Street	Between 17:53 on Friday 10 October and 13:55 on Tuesday 14 October 2025	Microphone approximately 2.7 m above ground in free-field conditions	Road traffic on Sackville Street, train passes on the viaduct.
S1	To capture road traffic noise from Charles Street	Daytime CTRN shortened measurement method, between 15:15 and 16:50 on 13 October 2025	Microphone approximately 1.2 m above ground in free-field conditions	Vehicle passes on Charles Street, road traffic on Sackville Street, bus movements and buses idling on Charles Street
S2	To capture sound from the A6	Daytime CTRN shortened measurement method, between 10:55 and 12:27 on 13 October 2025	Microphone approximately 1.2 m above ground in free-field conditions	Road traffic on the A6
S3	To capture entertainment noise from the venues to the north-west of the site. Measurements were carried out during an underground house and techno music club night at Joshua Brooks.	Between 23:21 on Friday 10 October and 00:55 on Saturday 11 October 2025	Microphone approximately 1.2 m above ground in free-field conditions at the part of the site boundary most exposed to entertainment noise	Bass noise from Joshua Brooks was audible but its contribution to the measured level was subjectively similar to that of road and rail noise. Towards the end of the measurements, music noise became more dominant than transport noise at low frequency as traffic volumes decreased. Higher frequency content of music noise was occasionally audible when the doors to Joshua Brooks were opened. Patrons in the smoking area outside Joshua Brooks on Princess Street and patrons outside the Garratt were also audible. There was a large queue outside the Factory extending down Princess Street that was clearly audible at the west side of the site.

Table 3: Summary of measurement positions

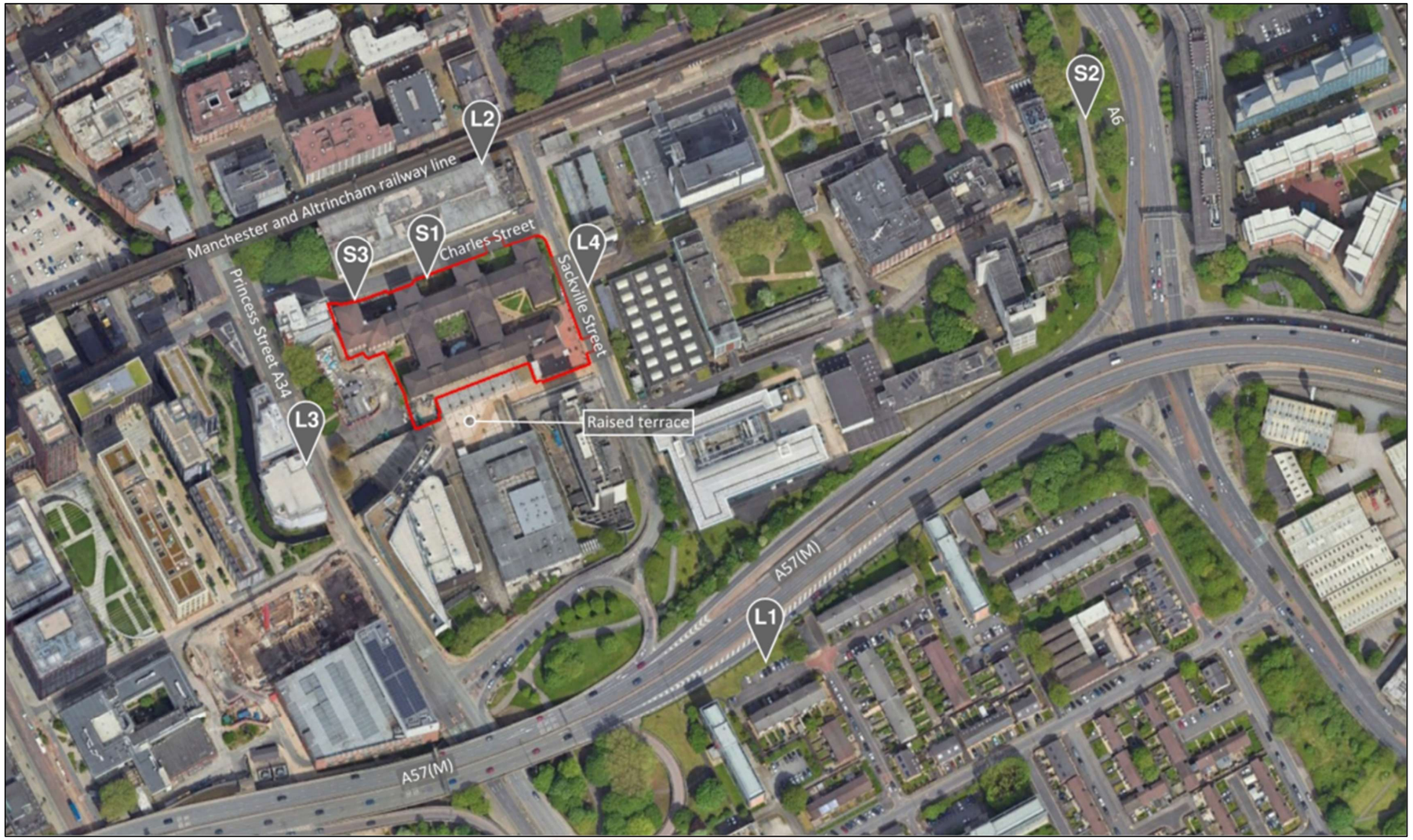


Figure 3: Measurement locations indicated by markers

4.9 **Results**

4.10 Measured environmental sound levels at each position are presented in Appendix A.

4.11 Short-term measurements were carried out at position S3 during the night-time to capture entertainment noise from the venues to the north-west of the site.

4.12 From the measured levels at position S3, a reasonably worst-case 5-minute period where the most significant source contributing to low-frequency noise levels was music noise has been selected as a design case. The measured levels are presented in Table 4. The 5-minute time history of the overall L_{Aeq} and 63 and 125 Hz octave-band levels is shown in Appendix A.

Position	Measured linear sound level, dB $L_{eq, 5\ min}$ Octave band centre frequency, Hz							dB(A)
	63	125	250	500	1k	2k	4k	
S3	71	64	58	57	58	53	45	61

Table 4: Measured free-field entertainment noise levels

4.13 Representative L_{A90} background sound levels used to set noise limits for mechanical plant noise emissions to off-site noise-sensitive locations have been determined in accordance with BS 4142 based on the frequency distribution graphs presented in Appendix A.

4.14 The 20th percentile of the measured $L_{A90, 15\ min}$ values for the daytime or night-time period has been taken as representative.

4.15 A similar analysis has been carried out in each octave band to derive limits for music noise break-out from the development.

4.16 The measured residual and background sound levels at positions L2 and L3 are summarised in Table 5.

4.17 A 3 dB correction has been applied to the measured residual and background levels at LT3 to determine free-field levels. This is a prudent assumption for the background sound levels since sources comprising the background sound environment are likely to be at a range of angles and distances from the façade, meaning that there will not be a specular reflection from the building behind.

Measurement location	Period	Range of residual sound levels, dB $L_{Aeq, 15\ min}$	Average residual sound level, dB $L_{Aeq, 15\ min}$	Representative background sound level, dB L_{A90}
L2	Daytime	52-67	60	46
	Night-time	47-69	57	42
L3	Daytime	62-78	67	53
	Night-time	57-77	66	46

Table 5: Summary of measured background and residual sound levels

Position	Typical night-time background sound level, dB L_{90} Octave band centre frequency, Hz						
	63	125	250	500	1k	2k	4k
L2	53	47	45	39	42	30	22
L3	49	46	44	41	42	37	29

Table 6: Typical octave band night-time background sound levels

5 Noise impact on the site

5.1 Noise model parameters

5.2 Sound transmission and propagation is modelled using proprietary software, Cadna/A, Reference 13. This models noise propagation outdoors according to ISO 9613, Reference 14.

5.3 The modelling parameters used, source of data and details are described in Table 7.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Architects' drawings	Architects' drawings, Reference 15
Topography –within site	Architect's drawings	Contour locations estimated from site levels shown on architect's drawings, Reference 15
Topography –Outside of site	Defra Services Platform Data Download	Height data at 1 m resolution converted to contour lines
Building heights – proposed buildings	Drawings	Architects' drawings
Building heights – outside of site	Site observations and Google Street view	Google Earth DSM height data used to infer heights for some buildings
Receptor positions	Site observations and Google Street view	On the façade closest to the source at heights representative of worst affected window locations
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB
G, Ground factor	ISO 9613-2	Hard ground, G = 0 Soft ground, G=1 locally
Max. order of reflections	Apex Acoustics	Three

Table 7: Modelling parameters and assumptions

5.4 Development phasing and site context

5.5 Planning policy DC 26.2 states that "the Council will take account both of noise exposure at the time of receiving a planning application and of any increase that may reasonably be expected in the foreseeable future."

5.6 The development is proposed to be completed in two phases – Phase A and Phase B. To ensure that the façade sound insulation strategy for Phase A is sufficient before Phase B is constructed, noise levels incident on the façade Building A have been calculated with Building B absent.

5.7 Demolition plans have been submitted for the car park to the north of the site and the Faraday Building to the south-east of the site. Removing these buildings may increase façade noise levels at lower floors of the proposed development; therefore, these buildings have not been included when modelling noise levels at the façades of the proposed development.

5.8 The development is bordered to the north, east and south by the ID Manchester Strategic Regeneration Framework area. The development plans have been reviewed and are not anticipated to significantly alter the noise levels experienced at the façades of the proposed development.

5.9 Existing mechanical plant

5.10 A site walk-around was conducted to identify any existing mechanical plant affecting the site.

5.11 Noise from a louvre located beneath the raised terrace at the western site boundary was significant on the raised terrace, at the southern façade of the existing building and on Princess Street where there was line of sight to the louvre. This louvre was identified by the client as the exhaust of a kitchen extract fan associated with the Pendulum hotel.

5.12 This extract fan will be removed before the construction of Phase A and will therefore not affect the proposed development. Position L3 was selected so that noise from this source was not audible during the survey set up. The extract fan does not run during the middle of the night and therefore does not affect the measured night-time background sound levels at LT-3 when transport noise levels at this position are lower.

5.13 Noise from a louvre associated with the university's underground car park was audible on Sackville Street but was not dominant or identifiable at the proposed building locations.

5.14 Various small items of plant were identified, including condensing units and small louvres on Weston Halls and the Ibis hotel, but noise from these sources only contributed significantly to the sound environment in their immediate vicinity.

5.15 Large chiller-type units and ductwork terminations are visible on aerial imagery of the roof of the Manchester Institute of Biotechnology to the south of the site. These will be overlooked by the upper floors of the proposed Phase A and Phase B buildings. It has not been possible to measure noise from these units.

5.16 The roof plant is at least 60 m from the nearest overlooking façades of the proposed buildings. Assuming a total sound power level of 100 dB L_{wA} for all plant on the roof of the institute (considered to be reasonably conservative based on the type and size of the units visible on aerial imagery) and applying a correction for distance, noise levels from the plant are calculated to be no greater than 56 dB L_{Aeq}. This is similar to or lower than the predicted level of transport noise at those façades.

5.17 At the upper building levels overlooking the plant, the sound environment will be dominated by road traffic noise on various routes through the city, particularly on high flow roads such as the A57 to the south. As such, we expect that sound levels at these facades will be relatively steady.

Noise from the plant is unlikely to be dominant or distinctive against the ambient sound environment.

5.18 The effect of uncertainty associated with potential noise levels from plant associated with the Manchester Institute of Biotechnology on the façade sound insulation requirements for the development is addressed in paragraph 7.12.

5.19 **Music noise impact**

5.20 Entertainment noise was measured at a position representative of the most exposed portions of façade. The measured levels are used directly in calculations of noise ingress for:

- the north façade of Phase A and B
- the west façade of Phase B, and
- the west façade of Phase A, since this will not be screened from the venues when built.

5.21 **Noise model calibration**

5.22 Measured daytime and night-time noise levels have been used to ascribe sound power levels to the surrounding roads and railway lines, and the noise impact at the proposed building façades has been calculated.

5.23 Measured maximum noise levels due to train movements and vehicle passes have been used to attribute sound power levels to point sources. For each source road or railway, the position of the point source has been shifted to calculate the potential worst-case noise impact at each building façade.

5.24 Maximum noise levels from the A57 and A6 have not been modelled. Noise from individual vehicle passes on these roads will typically not be distinctive above the ambient level at the site due to greater distance from the source and the steady nature of the sound from these roads due to high traffic volumes.

5.25 A plan view of the CadnaA model is shown in Figure 4.

5.26 Figure 5 to Figure 8 show noise levels calculated across the proposed building façades during the daytime and night-time.

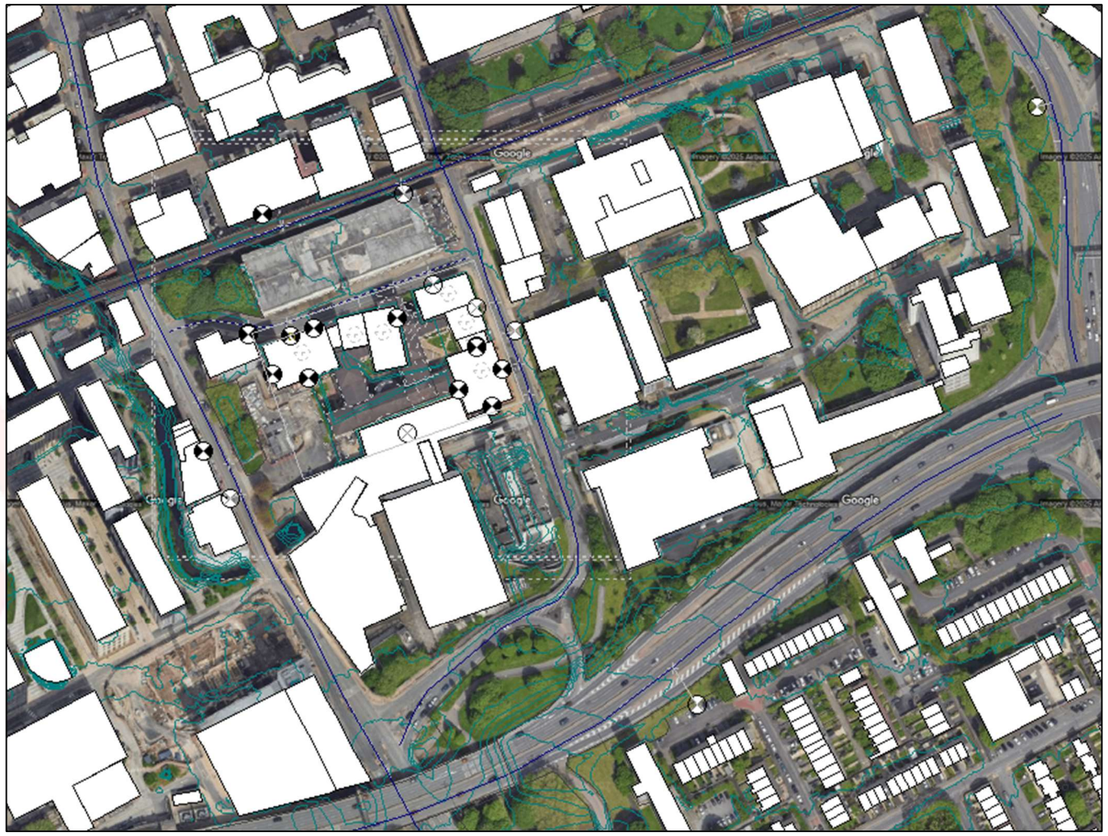


Figure 4: Plan view of the CadnaA model

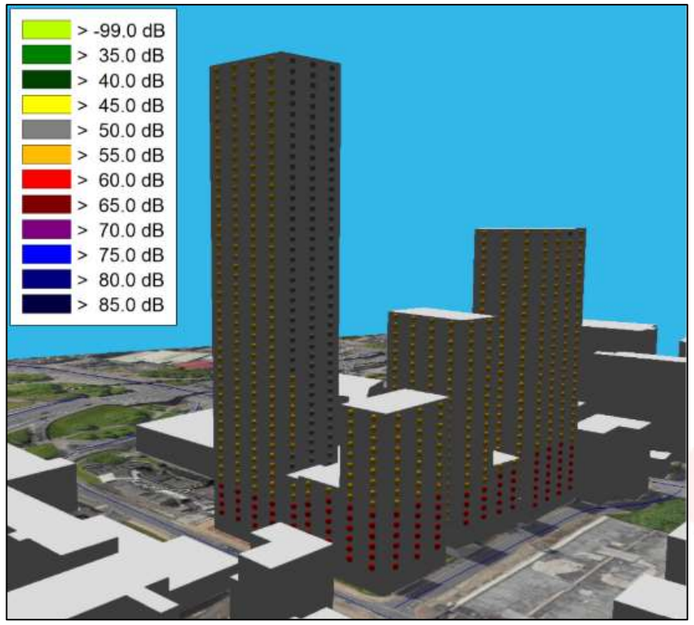


Figure 5: Daytime calculated $L_{Aeq,\ 16\ hr}$ at the building façades, shown from the north-east



Figure 6: Daytime calculated $L_{Aeq,\ 16\ hr}$ at the building façades, shown from the south-west



Figure 7: Night-time calculated $L_{Aeq,\ 8\ hr}$ at the building façades, shown from the north-east

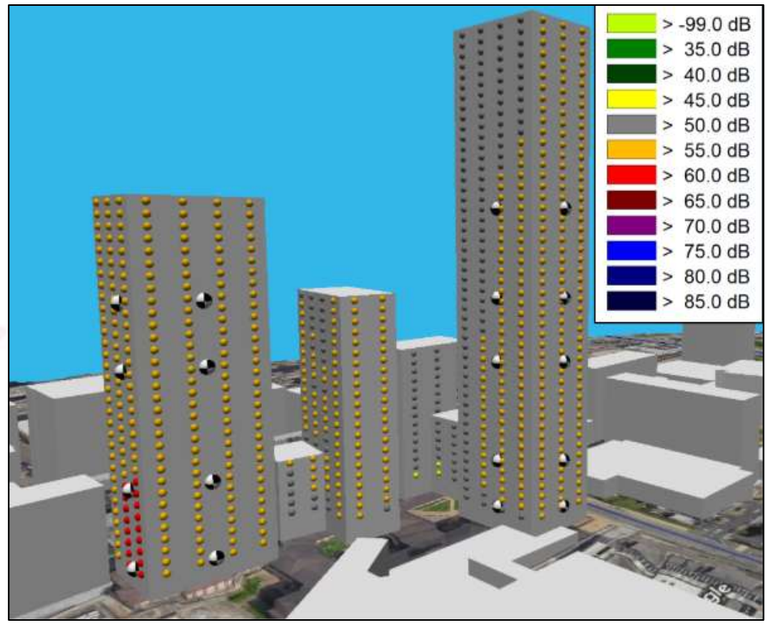


Figure 8: Night-time calculated $L_{Aeq,\ 8\ hr}$ at the building façades, shown from the south-west

6 External amenity area assessment

6.1 The areas of the site between Buildings A and B and to the south of Building B will be split into amenity space for exclusive student use ('The Courtyard') and a public access route linking the site with the wider area ('The Woodland Edge').

6.2 The Courtyard is considered as a shared external amenity space for the purposes of this assessment.

6.3 The site layout utilises the proposed buildings to screen the amenity space from the railway, Charles Street and Sackville Street. It is considered that the site layout reduces amenity area noise levels as far reasonably practicable.

6.4 Calculated noise levels in the external amenity space are shown in Figure 9.

6.5 Noise levels in The Courtyard are predicted to range between around 62 dB $L_{Aeq,\ 16\ hr}$ close to Charles Street and 53 dB $L_{Aeq,\ 16\ hr}$. The highest noise levels at the western edge of the amenity area are around 57 dB $L_{Aeq,\ 16\ hr}$.

6.6 The majority of The Courtyard is predicted to have noise levels not exceeding the 50-55 dB $L_{Aeq,\ T}$ range identified in ProPG. It is considered that sound levels in The Courtyard will not prevent the space from being used as intended.

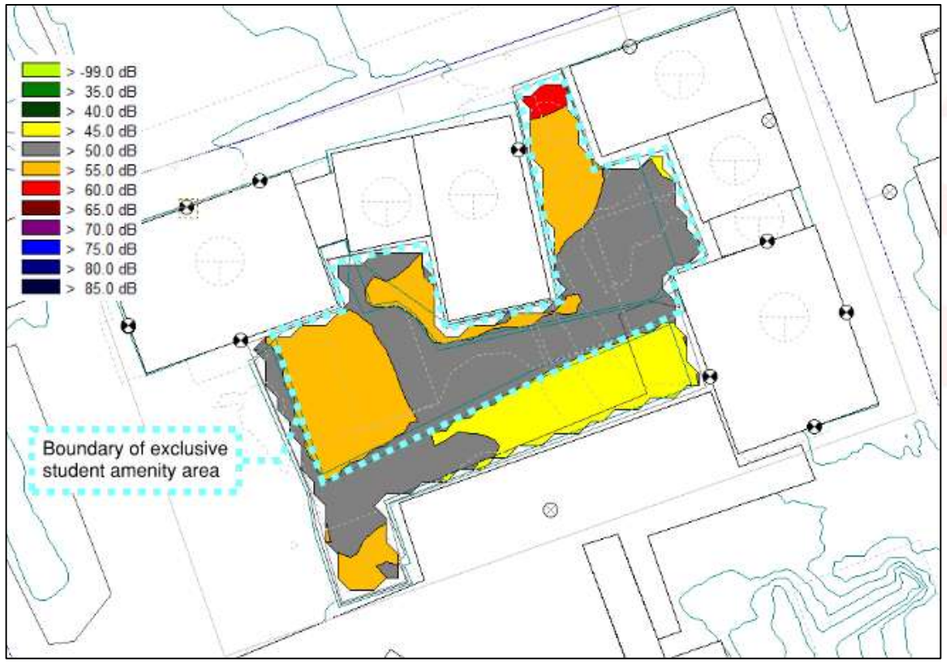


Figure 9: Calculated $L_{Aeq,\ 16\ hr}$ in external amenity space

7 External noise ingress

7.1 **Ventilation and overheating mitigation strategies**

7.2 Mechanical ventilation will be provided to all student bedrooms and cluster flats via mechanical ventilation and heat recovery (MVHR) units; therefore, windows are assumed to be closed for the purposes of assessing external noise ingress.

7.3 Each student bedroom will have an openable 'purge panel' for purge ventilation as defined in Approved Document F (AD-F), Reference 16 and to assist with control of overheating.

7.4 The overheating mitigation strategy for the development allows the purge panels to remain closed during the night-time period.

7.5 Purge ventilation conditions as described by AD-F, is manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and/or disperse water vapour.

7.6 For AD-F purge ventilation conditions, ProPG states:

"It should also be noted that the internal level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food)."

7.7 Considering this guidance, opening the purge panels is considered acceptable for these occasional events without giving rise to potential adverse effects on occupants.

7.8 If the proposed ventilation strategy changes from that described above, the façade sound insulation should be reassessed.

7.9 **External noise ingress calculations**

7.10 Calculations of external noise ingress have been carried out as follows:

- Calculation method in accordance with BS 8233 and the principles of BS EN 12354-3, Reference 17. Details of the methodology are provided on our website: https://www.apexacoustics.co.uk/calculation-facade-sound-insulation/.
- A 0.5 second reverberation time across the relevant frequency range is used for student bedrooms. This is taken from the value in ISO 16283, Reference 18, for a furnished living room.
- Dimensions of habitable rooms and window areas have been taken from the Simpson Haugh draft planning drawings, Reference 15.
- Ceiling heights are assumed to be 2.4 m.
- Calculations are carried out for the most exposed rooms – those with the largest ratio of window area to room volume, as well as those closest and most exposed to the noise

sources. Noise levels in less exposed but similarly protected rooms will be lower and therefore also comply with the internal noise level targets.

7.11 A BREEAM credit for internal ambient noise levels is sought for the development, so the building envelope is designed to achieve internal noise levels 3 dB lower than limits presented in this report.

7.12 For façades overlooking the plant on the roof of the Manchester Institute of Biotechnology, an additional 3 dB allowance has been made for noise from the rooftop plant based on the conservative estimates of plant noise described above. We consider that the risk of exceeding the MCC internal level criteria due to plant noise is low.

7.13 Example calculations for each glazing type are shown in Appendix A, based on manufacturer test data for the example glazing configuration supplemented by predictions of the glazing performance in the 63 Hz octave band.

7.14 **Building envelope sound insulation requirements**

7.15 Minimum glazing sound insulation requirements for student bedrooms in the development (including studios, twodios and cluster bedrooms) are presented in Table 8 and shown on the marked up drawings in Appendix B.

7.16 These glazing performance requirements are calculated to be sufficient to achieve internal ambient noise levels below the MCC Technical Guidance limits.

7.17 Kitchens in cluster flats are not considered as habitable rooms for the purposes of this assessment; however, any typical double-glazed unit would be sufficient to achieve daytime noise levels less than 35 dB $L_{Aeq,\ 16\ hr}$ in these spaces.

7.18 The minimum sound insulation requirements must be achieved in each frequency band.

Façade key (refer to Appendix B)	Typical night-time background sound level, dB L_{90} Octave band centre frequency, Hz							Example glazing configuration
	63	125	250	500	1k	2k	4k	
	24	26	27	34	40	38	46	10-12-6 mm double glazing
	24	25	22	32	41	45	46	4-16-8 mm double glazing
	19	20	19	29	38	36	45	6-12-6 mm double glazing

Table 8: Minimum glazing sound insulation requirements for student bedrooms

7.19 At this stage it is expected that the purge panel doors provided to each student bedroom will be glazed units. These must also achieve the minimum sound insulation requirements in Table 8.

7.20 The glazing performance requirements apply to the entire assembly including framing, seals to openable elements and any associated hardware.

7.21 Manufacturer's acoustic performance data for glazed elements is often provided for the insulated glazed unit (IGU) rather than the entire system. The element size, glass mounting method, framing and seals all influence the performance of the system as a whole, so the performance of the IGU is not always representative of the performance of the glazed window or door.

7.22 Based on the maximum glazing panel sizes proposed and the required acoustic performance, no corrections are required to account for differences between the sound insulation performance of the IGU and that of the system according to BS 14351, Reference 19. Therefore, manufacturer test data for the IGU would be acceptable to demonstrate agreement with the minimum glazing performance requirements listed in Table 8.

7.23 If the dimensions or acoustic performance requirements for the glazed units increase, this should be reassessed.

7.24 Opaque portions of the façade include:

- Pre-cast concrete panels backed with insulation and plasterboard linings
- Aluminium profiled screen or curtain wall extrusion backed with insulation and plasterboard boxing.
- Glazed unitised curtain walling with spandrel panels and plasterboard linings.

7.25 Opaque façade elements to bedrooms affected by the highest levels of external noise are required to achieve minimum 49 dB $R_w + C_{tr}$. The proposed build-ups are capable of achieving this performance requirement for opaque portions of the façade provided that:

- All glazing (including non-vision units) achieves the minimum performance requirements in Table 8.
- Fibrous insulation with a minimum density ≥ 9 kg/m^3 is used rather than rigid PIR type insulation
- Plasterboard linings/boxing consist of two layers of board with total minimum mass per unit area ≥ 16 kg/m^2, such as 2 x British Gypsum Wallboard.

7.26 Where the above assumptions do not hold, a detailed review of external noise ingress through all façade elements should be carried out once the details of the façade construction are further developed.

7.27 The roof is assumed to be concrete. Noise ingress through the roof is anticipated to be significantly lower than through the glazing.

8 Noise impact from amenity spaces

8.1 Amenity spaces in the development are yet to be allocated to a particular use, but we understand that spaces with the potential to generate high levels of noise will include a gym, karaoke room(s), cinema(s), gaming lounge.

8.2 Amenity spaces on upper floors will be private dining and lounge / study areas. Other proposed types of amenity space include group study lounges, lounge spaces, diner and private dining areas, analogue areas and a tabletop snug. These spaces will not generate high levels of noise and are therefore not considered further in this assessment.

8.3 Spatial planning will be used to separate the highest noise uses from residential spaces as far as possible.

8.4 This section presents a preliminary assessment of potential noise impacts from the proposed amenity spaces to the nearest off-site NSLs and residential spaces within the proposed development. An updated assessment of noise from these spaces should be carried out once details of the proposed activities and key constructions have been determined.

8.5 **Music noise break-out to the nearest NSLs**

8.6 Indicative calculations of music noise levels at the nearest NSLs have been carried out based on the following assumptions:

- High-noise amenity spaces located as shown in Figure 10. These locations have been selected to represent a reasonable worst case in terms of amenity room size and proximity to the NSLs.
- Reverberant music noise spectrum in Table 9 assumed as a reasonable worst-case, e.g. for a gym or karaoke room. This music noise spectrum is comprised of the highest sound level in each octave band from two reverberant sound spectra – one of music measured during a Zumba class and one for a cinema taken from a developer's specification.
- 10-12-6 mm double glazing to the full façade area. This glazing has been selected to demonstrate that the music noise limits are achievable; minimum glazing specifications should be determined based on the final amenity locations and uses.
- Windows to the amenity space are assumed to be closed. We understand that mechanical ventilation and cooling will be provided to these spaces.

8.7 The results of the assessment are summarised in Table 9. The MCC limits are achieved at all off-site NSLs. Potential noise levels at the existing student residential have also been checked based on the potential distance to proposed high-noise amenity spaces and are expected to comply with MCC's limits.

Parameter	Octave band centre frequency, Hz						
	63	125	250	500	1k	2k	4k
Assumed reverberant music noise level in amenity space, dB L_{eq}	92	92	90	85	83	83	80
Assumed sound reduction index of façade (10-12-6 mm double glazing), dB R	24	26	27	34	40	38	46
Music noise limit at NSL 1, dB L_{eq} [1]	44	41	39	36	37	32	24
Calculated music noise level at NSL 1, dB L_{eq}	38	37	36	23	16	12	1
Difference	-6	-4	-3	-13	-22	-20	-23
Music noise limit at NSL 2, dB L_{eq} [1]	48	42	40	34	37	25	17
Calculated music noise level at NSL 2, dB L_{eq}	37	36	36	24	17	14	4
Difference	-11	-6	-4	-10	-20	-11	-13
Music noise limit at NSL 3, dB L_{eq} [1]	44	41	39	36	37	32	24
Calculated music noise level at NSL 3, dB L_{eq}	35	33	33	21	15	12	1
Difference	-9	-8	-6	-15	-22	-20	-23

[1] Music noise limits are 5 dB below the typical octave band L_{A90} in Table 6.

Table 9: Worst-case calculation of music noise break-out to the nearest NSLs

8.8 Figure 10 shows calculated music noise contours at 1.5 m above ground.

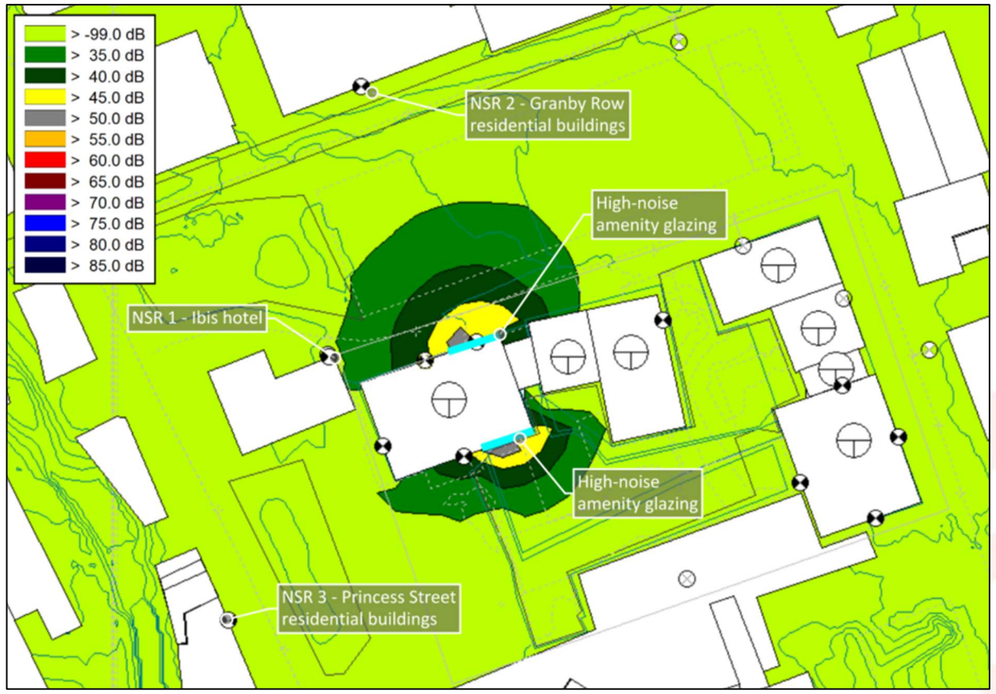


Figure 10: Music noise break-out contours at 1.5 m above ground

8.9 **Internal airborne sound insulation**

8.10 The proposed buildings will be concrete frame with 250 mm thick reinforced concrete floors. Partitions will generally have a drywall construction.

8.11 It is assumed at this stage that amenity spaces with high levels of music noise will not be located directly adjacent to a bedroom. We have considered sound transmission from a high-noise amenity space to a bedroom above.

8.12 Based on the music noise spectrum in Table 9, the minimum floor sound insulation performance to achieve the relevant criteria in the bedroom above is shown in Table 10.

8.13 In addition to the MCC criteria, iQ Student Residential's design guide requires that a standardised weighted level difference ≥ 65 dB $D_{nT,w}$ is achieved between high noise spaces such as a gym, cinema or karaoke room and a bedroom.

Parameter	Standardised level difference D_{nT} at octave band centre frequency, Hz		$D_{nT,w}$
	63	125	
Minimum on-site floor performance to achieve MCC and iQ Student Residential criteria	45	52	65

Table 10: Minimum on-site floor sound insulation requirements between high-noise amenity and bedroom

8.14 We calculate that these criteria can be achieved with the proposed 250 mm floor slab in combination with a high-mass ceiling such as:

- Ceiling on acoustic hangers, such as British Gypsum Gypframe GAH1
- Minimum 50 mm mineral wool insulation ≥ 9 kg/m^3 in the ceiling void
- Minimum 300 mm ceiling void
- Ceiling linings ≥ 25 kg/m^2, such as 2 x 15 mm British Gypsum SoundBloc.

8.15 Music noise levels at the façade of a bedroom directly above an amenity space have been calculated to ensure that noise ingress through the façade will not cause the MCC music noise criteria to be exceeded.

8.16 This has been confirmed based on the following assumptions:

- No façade elements will be continuous between the amenity space and bedroom above
- Windows to the amenity space are assumed to be closed
- 10-12-6 mm double glazed façade to amenity space
- 6-12-6 mm double glazing (green specification, see Table 8) to the bedroom
- 0.5 second flat reverberation time spectrum in the bedroom.

8.17 Once the amenity layouts are determined and the building design has progressed further, an assessment of noise transfer to sensitive spaces should be carried out to determine the required ceiling build-up, considering the direct sound through the separating element and potential noise flanking paths.

8.18 **Gym impact noise**

8.19 Impact sound from gyms, resulting from activities such as weight drops and treadmill use, can be very disruptive in sensitive spaces if not appropriately managed and acoustically treated.

8.20 Vibration from impacts should be controlled at source as far as practicable and prevented from entering the building structure. Vibration losses are low in structural elements, meaning that vibration can travel for significant distances around the building and be reradiated as audible noise, including within bedrooms on floors above the gym.

8.21 It is understood that the proposed gym is likely to include a free weights area, resistance machines and cardio machines. Free weights and resistance machines where stacks of weights are dropped are typically the highest risk activities for impact noise.

8.22 We understand that the gym is likely to be located on Level 1, but this is yet to be finalised.

8.23 As the location of the gym is yet to be determined, it is not possible to provide an outline specification for a suitable floor build up. At this stage, we recommend the following outline mitigation measures:

- Allow spatial and structural tolerances for a concrete floating floor and resilient matting, with a total system depth of 200-350 mm.
- Allow for a mass barrier ceiling to the gym to control airborne sound transmission to bedrooms above, as described in paragraph 8.14.
- Provide impact resistant washers beneath weight stacks in resistance machines
- Install suitable impact pads or plinths under treadmills.

8.24 We recommend that subjective testing is carried out to evaluate potential gym flooring types once the structural slabs are installed.

8.25 The most robust solution is to provide the same floor build up to the full gym area; however, floor types can be zoned according to use, e.g. restricting the concrete floating floor to weights areas. A resilient layer will still be required throughout the gym.

9 Building services noise emissions

9.1 Plant selections and layouts for the development are not yet finalised.

9.2 Noise rating level limits 5 dB below the background sound level are proposed for plant associated with the development operating in normal conditions to align with the MCC Planning and Noise Technical Guidance Note requirements.

9.3 Emergency plant including a backup generator and smoke extract fans is proposed. The generator will only run in the event of a power outage and for brief periods of testing twice per year. Given the brief duration of the operation, a relaxation of the rating level limits to 5 dB above the background level is proposed.

9.4 The plant noise limits should be achieved for plant from Phase A of the development at existing student accommodation and the nursery within the site, before these buildings are demolished as part of Phase B of the development.

9.5 The rating level limits are summarised in Table 11.

Location	Period	Rating level limit, dB $L_{Ar,Tr}$	
		Normal operation	Emergency conditions and testing
NSLs 1 and 3	Daytime	48	58
	Night-time	41	51
NSLs 2 and 4	Daytime	41	51
	Night-time	37	47

Table 11: Plant noise emissions limits

9.6 A full assessment of noise from mechanical plant against these limits should be carried out based on the final equipment selections and locations.

10 Conclusion

10.1 The main sources of environmental noise affecting the proposed development include road and rail traffic, and entertainment noise from nightlife venues to the north-west of the site.

10.2 Existing environmental sound levels have been measured and sound levels have been modelled across the development site.

10.3 The development will be mechanically ventilated, so windows are assumed to be closed for the purposes of the internal noise level assessment. The overheating mitigation strategy for the development enables purge panels to be closed during the night-time period.

10.4 Minimum façade sound insulation specifications to achieve MCC's internal noise level criteria in student bedrooms have been determined. These specifications address transport noise, music noise from nearby entertainment venues and existing sources of mechanical plant noise. The sound insulation of opaque portions of the façade should be reviewed as the design develops.

10.5 The site layout effectively screens external amenity areas from the nearest roads and the railway to the north of the site. Noise levels in external amenity areas for exclusive student use are considered to be broadly suitable based on MCC and ProPG guidance.

10.6 The locations of noise and vibration generating amenity spaces in the development have yet to be determined. The gym should be located on a ground-bearing slab if possible and high-noise spaces should be separated as far as practicable from student bedrooms.

10.7 Preliminary assessments of music noise break-out to off-site NSLs and internal sound transfer to sensitive spaces in the development have been carried out to demonstrate that the relevant MCC criteria for music noise can be achieved.

10.8 Detailed assessments of airborne and impact noise from high-noise spaces should be carried out once layouts are finalised and the building design has developed. The following should be reviewed:

- Minimum façade sound insulation requirements for amenity spaces
- Build ups of separating elements between high-noise and sensitive spaces, along with junction detailing and treatment of potential flanking pathways
- Gym floor build-up to control impact sound transfer, informed by subjective on-site testing of various floor types if possible.

10.9 iQ Student Accommodation will manage the whole building, so any complaints from residents will be addressed internally in the first instance. This situation is considered to reduce the risk of ongoing noise issues associated with the gym, since iQ will have the ability to manage gym activities if necessary.

10.10 Limits for fixed mechanical plant associated with the development have been specified based on measurements of the background sound level and guidance in BS 4142. Noise emissions from the development should be assessed in detail once the mechanical design has been developed.

10.11 Based on the existing noise risks and details outlined in this report, the site is considered suitable for student accommodation.

11 References

1 National Planning Policy Framework, Department for Communities and Local Government, December 2024.

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

3 Manchester City Council, Manchester Core Strategy Development Plan Document, 11/07/2012.

4 Manchester City Council, Planning and Noise Technical Guidance, October 2022.

5 Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), "ProPG: Planning & Noise - New Residential Development," May 2017.

6 BS 4142: 2014, Method for rating and assessing industrial and commercial sound.

7 Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), "ProPG: Gym Acoustics Guidance," March 2023.

8 BS 8233: 2014, Guidance on sound insulation and noise reduction for buildings.

9 Guidelines for Community Noise, Edited by Birgitta Bergland, Thomas Lindvall, Dietrich H Schwela, World Health Organisation, 1999.

10 BS 7445:2003, Description and measurement of environmental noise. Guide to quantities and procedures.

11 Calculation of Railway Noise, Department of Transport, 1995.

12 Calculation of Road Traffic Noise, Department of Transport, 1988.

13 Cadna/A environmental noise modelling software, version 2024, Datakustik GmbH.

14 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors.

15 Simpson Haugh planning drawings issued 16/12/2025, including Z0 G100 PL series (Proposed GA Plans), Z0 G100 EL series (Site Context Elevations), Z0 G100 SE series (Sections), Z0 G251 DE & EL series (detail elevations).

16 Approved Document F 2021 Edition, The Building Regulations 2010.

17 BS EN 12354-3:2000, Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements Part 3: Airborne sound insulation against outdoor sound.

18 BS EN ISO 16283-1:2014 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation.

19 BS EN ISO 14351-1: 2006+A1:2016 Windows and doors. Product standard, performance characteristics - Windows and external pedestrian doorsets

20 Transport Research Laboratory / Defra, Method for converting the UK road traffic noise index $L_{A10,\,18\,hr}$ to the EU noise indices for noise mapping, 2006.

Appendix A Noise survey equipment and results

A.1 Noise survey equipment

A.2 The survey equipment used is listed in Table 12.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-11084-E0
Calibrator	Larson Davis CAL 200	10665
Sound Level Meter	NTi XL2	A2A-11062-E0
Calibrator	Larson Davis CAL 200	13403
Sound Level Meter	NTi XL2	A2A-20287-E0
Calibrator	Larson Davis CAL 200	19379
Sound Level Meter	NTi XL3	A3A-01140-F0
Calibrator	Larson Davis CAL 200	21846
Sound Level Meter	NTi XL3	A3A-01135-F0
Calibrator	Larson Davis CAL 200	22086

Table 12: Equipment used

A.3 Noise survey results – transport noise sources

A.4 From the long-term surveys carried out at measurement positions 1-4, the highest measured daytime $L_{Aeq,\ 16\ hr}$ and night-time $L_{Aeq,\ 8\ hr}$ levels have been selected for use in the noise model calibration.

A.5 For each night-time period at each of the long-term positions, the tenth highest measured maximum sound level has been identified. The highest of these which is attributed using audio recordings to a passing vehicle or train is used as the design case to model maximum sound levels impacting on the façades of the proposed buildings. Maximum noise events that cannot be localised based on the audio recordings have been disregarded and the next loudest maximum noise event has been assessed.

A.6 The measured levels at the long-term positions are shown in Table 13.

A.7 The time histories of the measured $L_{Aeq,\ 5\ min}$ are shown in Figure 11 to Figure 14.

Position	Parameter	Octave band centre frequency, Hz						dB(A)
		125	250	500	1k	2k	4k	
L1 (free-field)	Daytime, $L_{Aeq,\ 16\ hr}$	64	62	62	66	63	52	69
	Night-time, $L_{Aeq,\ 8\ hr}$	62	59	60	64	60	52	67
	Night-time, L_{AFmax}	74	89	80	74	69	62	83
L2 (treated as free-field)	Daytime, $L_{Aeq,\ 16\ hr}$	64	61	61	60	58	55	65
	Night-time, $L_{Aeq,\ 8\ hr}$	62	57	56	55	51	47	59
	Night-time, L_{AFmax}	76	80	77	72	69	63	78
L3 (façade)	Daytime, $L_{Aeq,\ 16\ hr}$	65	65	63	67	62	57	70
	Night-time, $L_{Aeq,\ 8\ hr}$	64	65	67	69	64	57	72
	Night-time, L_{AFmax}	71	77	76	84	75	62	85
L4 (free-field)	Daytime, $L_{Aeq,\ 16\ hr}$	62	62	61	63	58	50	66
	Night-time, $L_{Aeq,\ 8\ hr}$	59	59	58	61	57	50	64
	Night-time, L_{AFmax}	69	72	74	78	72	60	80

Table 13: Measured noise levels – long term measurement positions

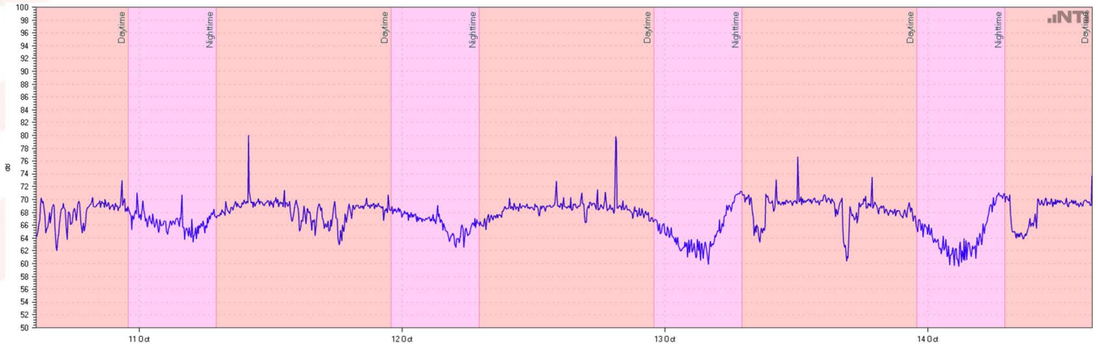


Figure 11: Measured time history at L1

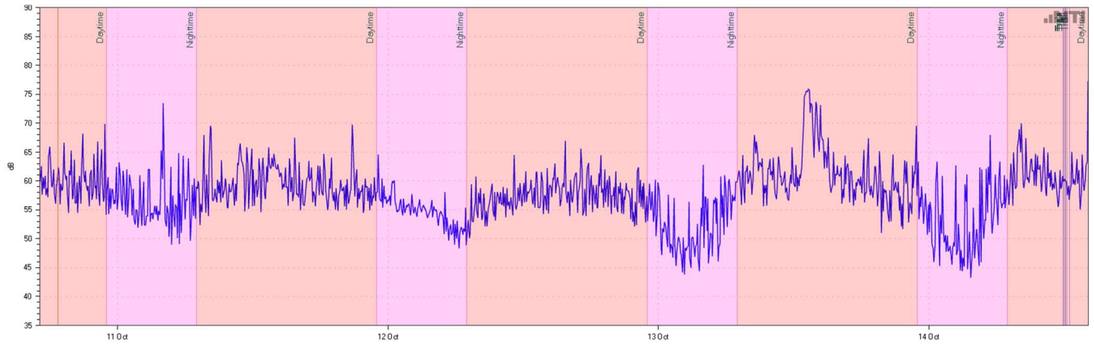


Figure 12: Measured time history at L2

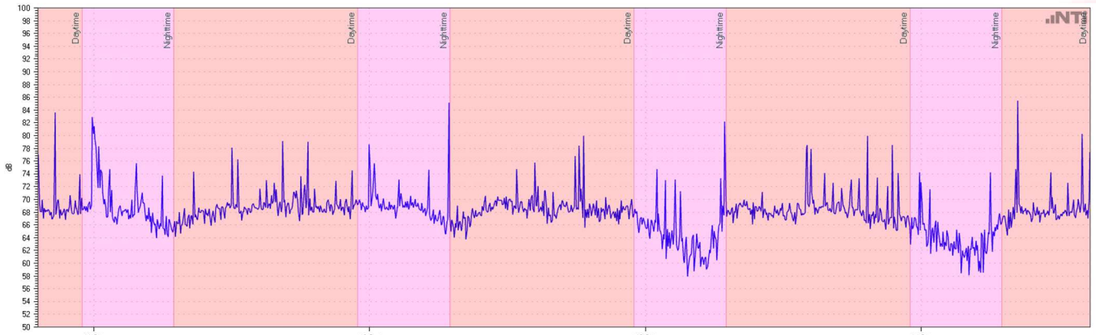


Figure 13: Measured time history at L3

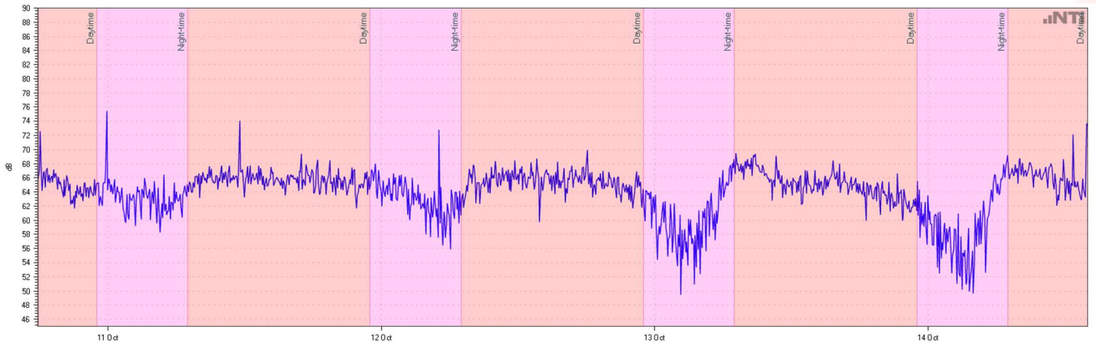


Figure 14: Measured time history at L4

A.8 At positions 5 and 6, measurements were carried out using guidance from the shortened measurement procedure detailed in CRTN. $L_{A10,\ 18\ hr}$ noise levels have been calculated from the measured $L_{A10,\ 1\ hr}$ over three consecutive hours.

A.9 The methodology of the Transport Research Laboratory, Reference 20, has been used to determine day ($L_{Aeq,\ 12\ hr}$), evening ($L_{Aeq,\ 4\ hr}$) and night-time ($L_{Aeq,\ 8\ hr}$) noise levels. Day and evening levels have been summed with an appropriate time weighting to determine the daytime $L_{Aeq,16\ hr}$.

A.10 The measured values of the L_{A10} for three consecutive hours and calculation of the $L_{Aeq,\ 16\ hr}$ and $L_{Aeq,\ 8\ hr}$ are shown in Table 14.

Parameter	S1	S2
Measured noise level, dB $L_{A10,\ 1\ hr}$ – First hour	64	74
Measured noise level, dB $L_{A10,\ 1\ hr}$ – Second hour	65	74
Measured noise level, dB $L_{A10,\ 1\ hr}$ – Third hour	66	74
Calculated $L_{A10,\ 18\ hr}$	64	74
Calculated $L_{Aeq,\ 16\ hr}$	62	70
Calculated $L_{Aeq,\ 8\ hr}$	54	63

Table 14: Calculation of daytime and night-time levels at S1 and S2

A.11 The measured noise spectrum at each position has been shifted to meet the daytime and night-time A-weighted sound levels.

A.12 At S1, the highest maximum sound level from a passing vehicle during the daytime measurement period is taken as the design case. Maximum noise levels from buses on Charles Street have not been considered since fewer than 10 buses are scheduled during the night-time period.

A.13 $L_{Aeq,\ 16\ hr}$, $L_{Aeq,\ 8\ hr}$ and L_{AFmax} sound levels used in the model calibration are shown in Table 15.

Position	Parameter	Octave band centre frequency, Hz						dB(A)
		125	250	500	1k	2k	4k	
S1	Daytime, $L_{Aeq,\ 16\ hr}$	62	60	56	58	54	48	62
	Night-time, $L_{Aeq,\ 8\ hr}$	50	51	48	52	45	36	54
	Night-time, L_{AFmax}	82	78	72	73	72	68	79
S2	Daytime, $L_{Aeq,\ 16\ hr}$	67	67	65	68	62	52	70
	Night-time, $L_{Aeq,\ 8\ hr}$	59	59	57	60	54	44	63

Table 15: Calculated free-field noise levels –short-term measurement positions

A.14 Analysis of music noise levels

A.15 The 5-minute time history of the overall $L_{Aeq,\ 5\ sec}$ (blue), octave band $L_{eq,\ 5\ min}$ at 63 Hz (green) and $L_{eq,\ 5\ min}$ at 125 Hz (red) measured at position S3 is shown in Figure 15. Design case sound levels are presented in Table 4 – the design period is highlighted in red below.

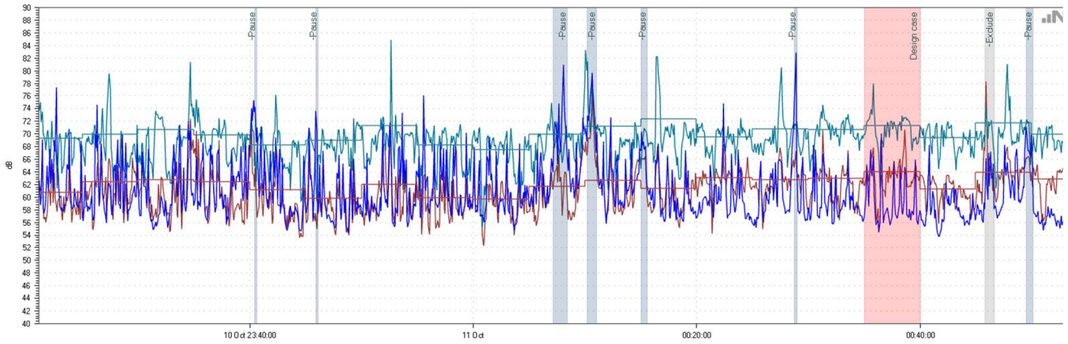


Figure 15: Measured $L_{Aeq,\ 5\ sec}$ (blue), $L_{eq,\ 5\ min}$ at 63 Hz (green) and $L_{eq,\ 5\ min}$ at 125 Hz at S3

A.16 Background sound level analysis

A.17 Cumulative distributions of the measured daytime and night-time $L_{A90,\ 15\ min}$ at L2 and L3 are shown in Figure 16 to Figure 19.

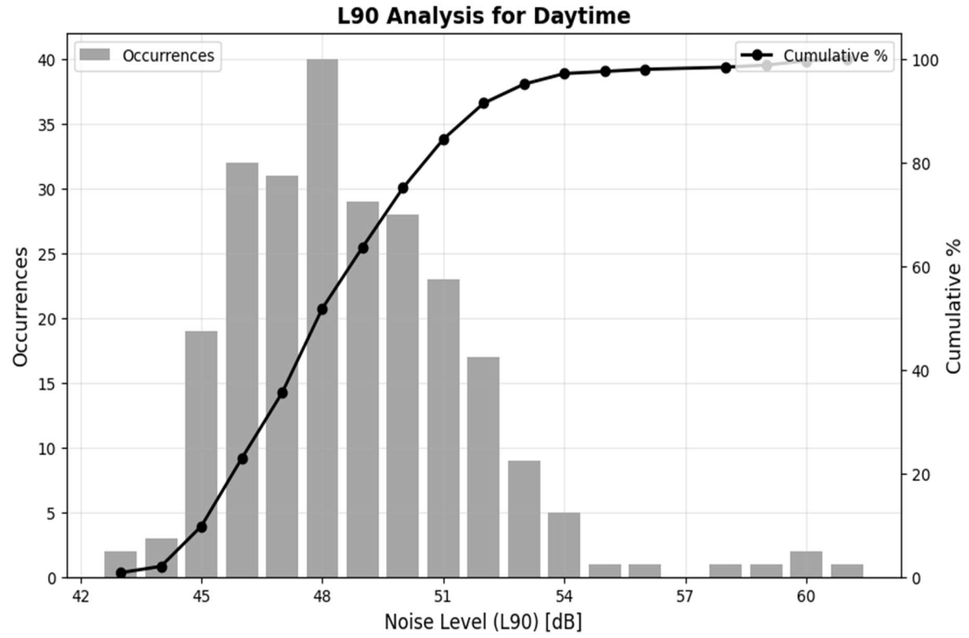


Figure 16: Cumulative distribution of measured daytime $L_{A90,\ 15\ min}$ at position L2

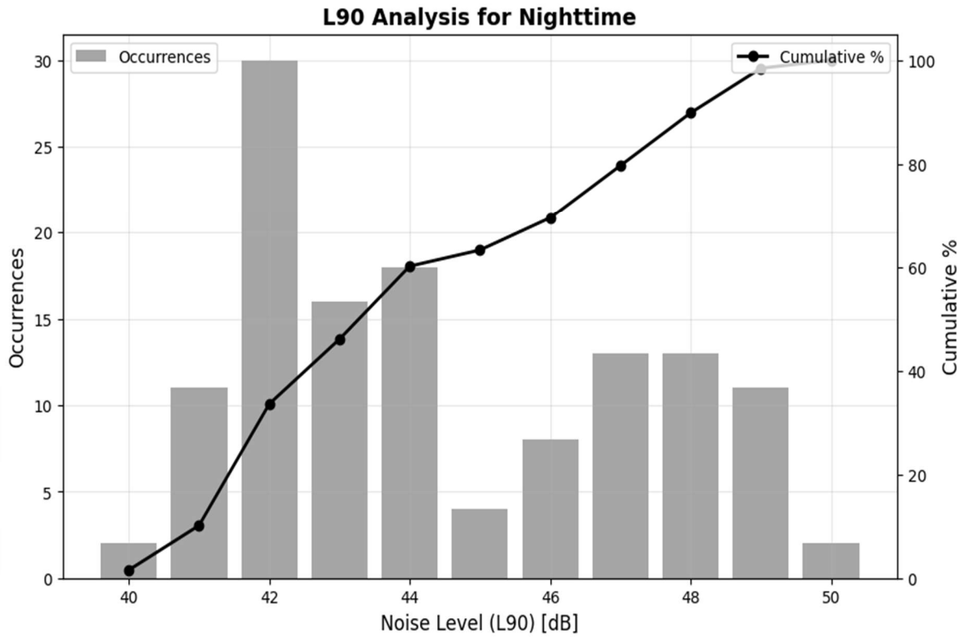


Figure 17: Cumulative distribution of measured night-time $L_{A90,\ 15\ min}$ at position L2

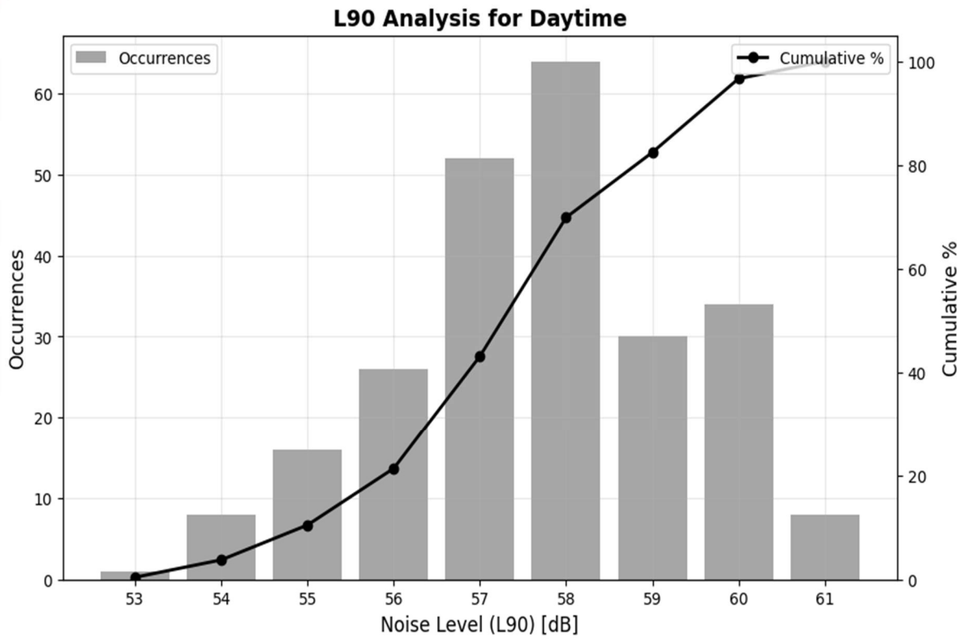


Figure 18: Cumulative distribution of measured daytime $L_{A90,\ 15\ min}$ (façade levels) at position L3

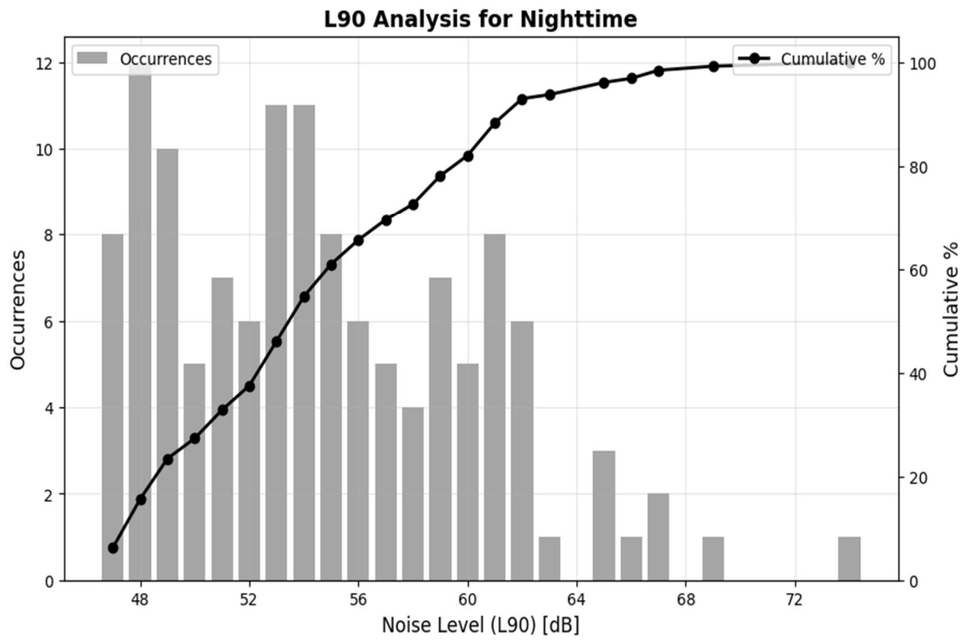


Figure 19: Cumulative distribution of measured night-time $L_{A90,\,15\,min}$ (façade levels) at position L3

Appendix B Façade sound insulation requirements

B.1 The colours on the following mark-ups relate to the minimum acoustic performance requirements for glazing in Table 8.



Apex Acoustics
Design Works, William St,
Gateshead, NE10 0JP
www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 00

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

CHARLES STREET

SACKVILLE STREET

Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 01

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

CHARLES STREET

SACKVILLE STREET

Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

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Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 02

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

CHARLES STREET

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Apex Acoustics

Design Works, William St,
Gateshead, NE10 0JP

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Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 03

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

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Date:	09/12/2025
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Checked by:	AC

Facade sound insulation requirements - Level 04-07

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

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Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 08-10

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

CHARLES STREET

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Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 11

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

CHARLES STREET

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Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 12-16

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.



Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

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Date:	09/12/2025
Markup by:	BP
Checked by:	AC

Facade sound insulation requirements - Levels 17-20, 22-23

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

CHARLES STREET

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Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 21

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.



Apex Acoustics

Design Works, William St, Gateshead, NE10 0JP

www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 24-30

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.



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Design Works, William St, Gateshead, NE10 0JP

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Date: 09/12/2025

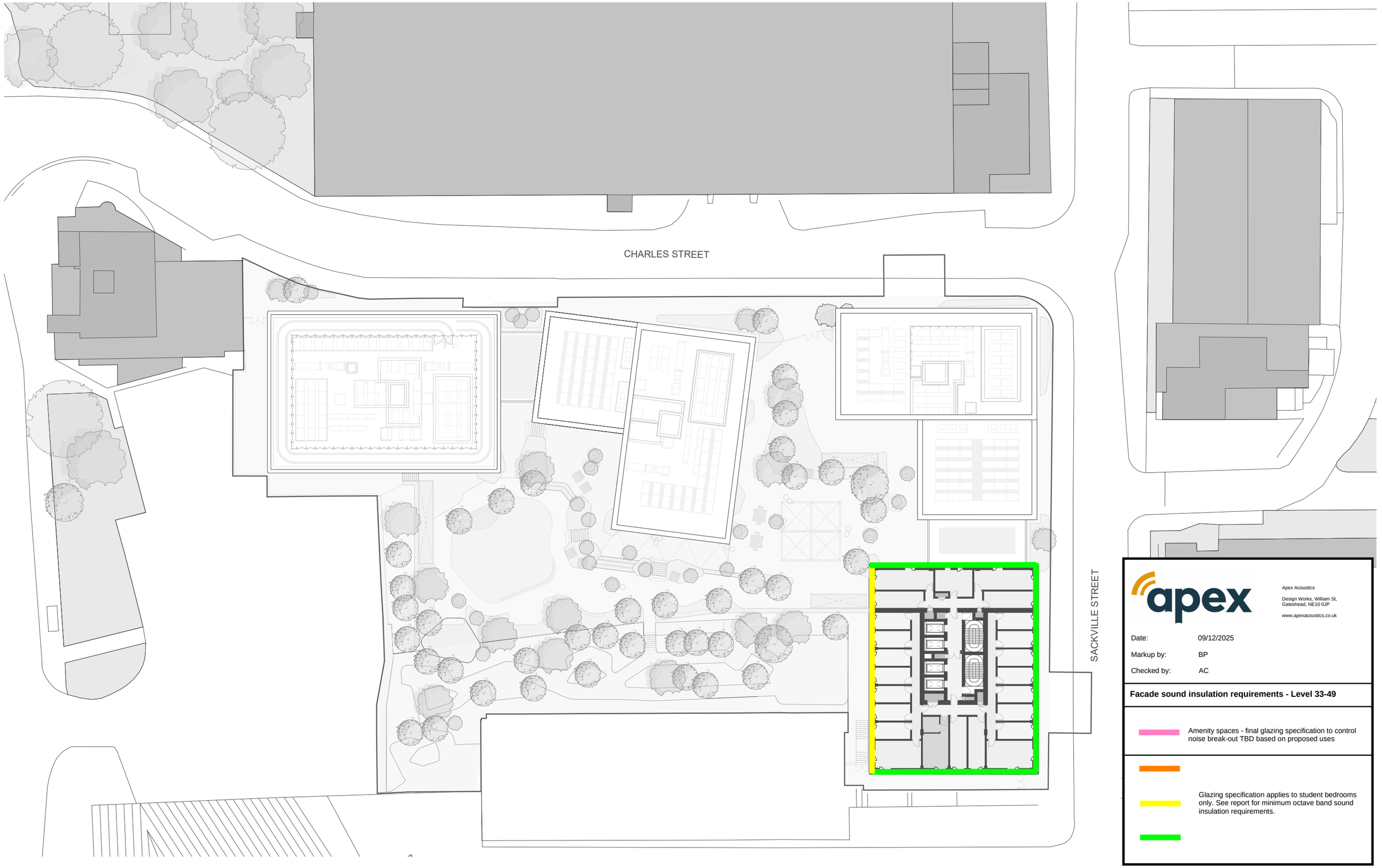
Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 31

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.



Apex Acoustics
Design Works, William St, Gateshead, NE10 0JP
www.apexacoustics.co.uk

Date: 09/12/2025

Markup by: BP

Checked by: AC

Facade sound insulation requirements - Level 33-49

Amenity spaces - final glazing specification to control noise break-out TBD based on proposed uses

Glazing specification applies to student bedrooms only. See report for minimum octave band sound insulation requirements.

Appendix 14.2: Abbreviations and definitions

1. Abbreviations

- BNL - Basic Noise Level - defined in the DMRB at a reference distance of 10 m from the nearside carriageway edge, calculated based on 18-hour traffic flow, speed and HGV percentage data, as per the methodology set out in CRTN
- BPM - Best Practicable Means - defined in Section 72 of the Control of Pollution Act 1974, refers to measures that are reasonably practicable having regard among other things to: local conditions and circumstances; the current state of technical knowledge; and the financial implications.
- CEMP - Construction Environmental Management Plan - a document that details how a construction project will minimise its negative environmental impact.
- CoPA - Control of Pollution Act 1974
- CRTN - Calculation of Road Traffic Noise - a standardised method for predicting and measuring noise from road traffic.
- DMRB - Design Manual for Roads and Bridges - requirements and advice documents relating to the design, assessment and operation of motorway and all-purpose trunk roads in the UK.
- LOAEL - Lowest Observed Adverse Effect Level – the level above which adverse effects on health and quality of life occur.
- NOEL - No Observed Effect Level – the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established.
- SOAEL - Significant Observed Adverse Effect Level - the level above which significant adverse effects on health and quality of life occur.

2. Definitions

2.1 Sound Pressure Level and the decibel (dB)

2.2 A sound wave is a small fluctuation of pressure in air. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. Due to the wide range of pressure variations detectable by the ear, a logarithmic scale is used to convert the values into manageable numbers. The dB (decibel) is the logarithmic unit used to describe sound

(or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

2.3 **Frequency and Hertz (Hz)**

2.4 Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequencies are often written as kilohertz (kHz), where 1kHz = 1000Hz.

2.5 Young people with normal hearing can hear frequencies in the range 20Hz to 20kHz. However, the upper frequency limit gradually reduces as a person gets older. As the ear hears some frequencies better than others, the A-weighting scale is used to mimic human hearing. A-weighing applies a correction to the sound level at a given frequency depending on how well the ear hears that frequency.

2.6 **Noise Descriptors and Indices**

2.7 In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

- L_{Aeq}: This is the A-weighted equivalent continuous sound level which can be thought of as an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous sound which has the same total (A-weighted) energy as the real fluctuating sound, measured over the same time period. L_{Aeq} is the most commonly used general purpose descriptor for environmental noise.
- L_{Amax}: This is the maximum A-weighted sound level recorded during the monitoring period.
- L_{A90}: This is the A-weighted sound level exceeded for 90% of the measurement period.
- L_{A90} is used as a measure of background sound.
- L_{A10}: This is the A-weighted sound level exceeded for 10% of the time period and is often used in the assessment of road traffic noise.

Appendix 14.3: Legislative Framework, Policy and Guidance

1. Control of Pollution Act (CoPA)

1.1 Part III of the Control of Pollution Act 1974 (CoPA) is specifically concerned with pollution. With respect to noise it covers construction sites, noise in the street, noise abatement zones, codes of practice and best practicable means (BPM).

1.2 Section 60 of the CoPA refers to the control of noise on construction sites. It enables local authorities to control noise from construction sites to prevent noise disturbance occurring.

1.3 The CoPA enables the local authority in whose area work is going to be undertaken, or is being undertaken, to serve a notice imposing requirements as to the way in which construction works are to be carried out. This notice can specify the plant or machinery that is or is not to be used, the hours during which the construction work can be carried out, the level of noise and vibration that can be emitted from the premises in question or at any specified point on these premises or that can be emitted during specified hours.

1.4 Section 61 of the CoPA refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. If consent is given, and the stated method and hours of work are complied with, then the local authority cannot take action under Section 60.

1.5 Section 71 of the CoPA refers to the preparation and approval of codes of practice for minimising noise.

1.6 Section 72 of the CoPA refers to Best Practicable Means (BPM), which is defined as:

1.7 “reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications’. Whilst ‘Means’ includes ‘the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structure.”

1.8 If BPM is applied, then it can provide a defence against prosecution by the local authority.

2. Environmental Protection Act 1990, Part III (EPA)

2.1 The Environmental Protection Act 1990 (EPA) deals with statutory nuisance, including noise.

2.2 Section 79 of the EPA, 'Statutory nuisances and inspections therefor', places a duty on local authorities to regularly inspect their areas to detect whether a statutory nuisance exists. This section also considers and defines the concept of BPM, which originates from Section 72, Part III of the CoPA.

2.3 Where the local authority is satisfied that a statutory nuisance does exist, or is likely to occur or recur, it must serve an abatement notice. Section 80, Part III of the EPA, 'Summary proceedings for statutory nuisances', provides local authorities with the power to serve an abatement notice requiring the abatement of the nuisance or prohibiting or restricting its occurrence or recurrence; and/or carrying out such works or other action necessary to abate the nuisance.

2.4 Section 82 of the EPA, 'Summary proceedings by persons aggrieved by statutory nuisances', allows a Magistrates' court to act on a complaint made by any person on the grounds that he is aggrieved by a statutory nuisance, such as noise.

2.5 The procedures for appeals against abatement notices are detailed in the Statutory Nuisance (Appeals) Regulations 1995.

3. Noise Policy Statement for England (NPSE)

3.1 The Noise Policy Statement for England (NPSE) published in March 2010 by Defra, aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.

3.2 Paragraph 1.6 of the NPSE sets out the long-term vision and aims of Government noise policy:

"Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

"Noise Policy Aims

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."

3.3 The aims require that all reasonable steps should be taken to avoid, mitigate and minimise adverse effects on health and quality of life, whilst also taking into account the guiding principles of sustainable development, which include social, economic, environmental and health considerations.

3.4 With regard to the terms 'significant adverse' and 'adverse' included in the 'Noise Policy Aims', these are explained further in the 'Explanatory Note' as relating to established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation which are:

"NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on human health and quality of life due to noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected."

3.5 Defra has then extended these concepts for the purpose of the NPSE to introduce the concept of:

"SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur."

3.6 The accompanying explanation states:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

4. Planning Practice Guidance – Noise

4.1 Published in March 2014 and updated in July 2019, Planning Practice Guidance – Noise ('PPG-N') is a web-based resource to support the NPPF.

4.2 This reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE, relevant guidance and British Standards, and contains examples of acoustic environments commensurate with various effect levels. A summary of the guidance from the NPSE and PPG-N is set out in Table 3-1 below.

4.3 PPG-N provides tabulated descriptions of example outcomes of the 'effect level' categories introduced in the NPSE based on the likely average response. It also adds two additional categories termed NOAEL (No Observed Adverse Effect Level) and Unacceptable Adverse Effect Level (UAEL).

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

Table 3-1: PPG-N Guidance

5. British Standard 5228-1 and -2

5.1 British Standard (BS) 5228 is a two-part standard which comprises:

- BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (BS 5228-1) and
- BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' (BS 5228-2)

5.2 The Standard provides guidance, information and procedures regarding the control of noise and vibration from demolition and construction sites.

5.3 There are no set standards for the definition of the significance of construction noise effects. However, for noise, example criteria are provided in BS 5228-1 Annex E, and for vibration, example criteria are provided in BS 5228-2 Annex B. The assessment of whether changes in noise levels due to construction activity constitute significant effects will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration, time of occurrence and frequency of the noise change.

5.4 BS 5228-1 provides basic information and recommendations for methods of noise control relating to construction and open sites where work activities or operations generate significant noise levels, including:

- community relations;
- noise and persons on site;
- neighbourhood nuisance;
- project supervision, and
- control of noise.

5.5 The annexes including information on legislative background, noise sources, remedies and their effectiveness (mitigation options), current and historic noise level data for on-site equipment and site activities, potential significance of noise effects, calculation procedures estimating noise emissions from sites and noise level monitoring, types of piling, and air overpressure.

5.6 BS 5228-2 provides basic information and recommendations for methods of vibration control relating to construction and open sites where work activities or operations generate significant vibration levels. It includes sections on community relations,

vibration and persons on site, neighbourhood nuisance, project supervision and control of vibration and measurement.

6. Design Manual for Roads and Bridges, LA111 'Noise and Vibration' (Highways England)

6.1 The Design Manual for Roads and Bridges (DMRB), LA111 'Noise and Vibration', Revision 2, May 2020 provides guidance on methods for assessing and reporting the effects of highways noise and vibration from construction, operation and maintenance projects.

6.2 In relation to the proposed development, the guidance provides methods for assessing the magnitude of traffic noise impact during construction and operation, using predicted a change in traffic noise levels, calculated using methods outlined in Calculation of Road Traffic Noise (CRTN) (Department of Transport, 1988). The guidance also defines LOAELs and SOAELs for construction noise and provides guidance on the potential effect due to the magnitude of change.

7. Calculation of Road Traffic Noise 1988

7.1 The Department of Transport Calculation of Road Traffic Noise (CRTN), HMSO, 1988 describes procedures for measuring and calculating noise from road traffic. The calculation procedures are suitable for general applications such as environmental appraisal of road schemes, highway design and land use planning. The document can also be used to assess the change in noise level due to changes in traffic flow conditions. For this assessment this guidance is used to assess noise from construction traffic.

7.2 The index adopted by CRTN to assess traffic noise is $L_{A10,18h}$. This value is determined by taking the highest 10% of noise readings in each of the 18 one-hour periods between 06:00 and 00:00, and then calculating their arithmetic mean.

8. Institute of Sustainability and Environmental Professionals (ISEP) 'Guidelines for Environmental Noise Impact Assessment'

8.1 The Institute of Sustainability and Environmental Professionals ('ISEP', formerly known as the Institute of Environmental Management and Assessment) guidance addresses the key principles of noise impact assessment, and provides specific support on how noise impact assessment fits within the Environmental Impact Assessment ('EIA') process.

8.2 These guidelines define core methods and techniques for EIA captured within the EIA regulations. It also refers to the requirements in NPPF and NPSE.

8.3 In the ISEP guidance, a Noise Effect is defined as the consequence of the noise impact. This may be in the form of change in noise level, change in degree of intrusion, or perceived change in quality of life. The effect will also be dependent on the receptor and sensitivity. The Significance of Effect is defined as the evaluation of the noise effect, and deciding whether that impact is significant.

Appendix 14.4: Details of the construction noise assessment

1. Introduction

1.1 This appendix provides additional details of the construction noise assessment, including a summary of baseline noise levels and BS 5228-1 threshold values at each receiver, assumptions about construction activities, durations and location relative to each receptor, and predicted noise levels for each construction phase.

2. Baseline and threshold levels

2.1 Ambient noise levels around the site were measured as part of the baseline noise surveys, and noise levels from the existing transport sources have been modelled for the site and surrounding area. Details of the measurements and modelling are provided in the noise impact assessment prepared to support the planning application for the development, which is provided in Appendix 14.1.

2.2 Noise contours showing the predicted ambient noise levels for the area surrounding the site are shown in Figure 4-1. The lowest $L_{Aeq,\ 16\ hr}$ noise level calculated at the building façade(s) facing the construction site is taken as the baseline noise level. These ambient noise levels are then rounded to the nearest 5 dB to determine the threshold level according to Table E.1 of BS 5228-1. Threshold levels are only determined within the site working hours, which will be:

- Monday to Friday: 0730 to 1800 hours
- Saturday: 0730 to 1300 hours.

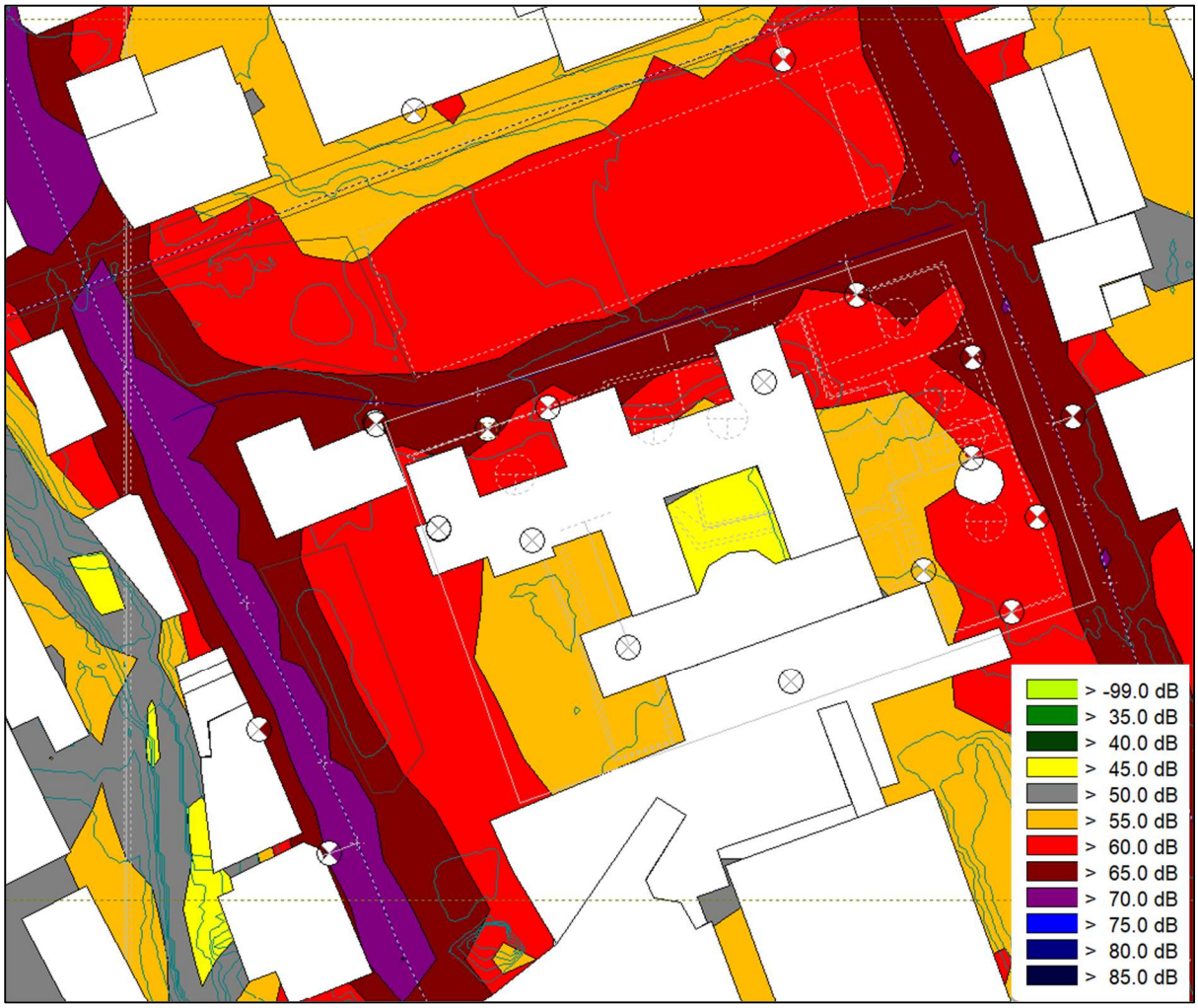


Figure 4-1: Calculated daytime baseline sound contours at 1.5 m above ground

2.3 Table E.1 of BS5228-1 provides a methodology (the 'ABC method') for determining the potential significance of noise effects due to construction activities, based on the periods of construction (daytime, evening and night-time) and the baseline ambient noise levels at the receptors.

2.4 The baseline ambient noise levels are rounded to the nearest 5 dB and then allocated into a threshold category (A to C). The predicted construction noise levels are then assessed against the corresponding noise threshold value. If the noise threshold value is exceeded, a potential significant impact may be considered to occur.

2.5 The standard then states that the assessor needs to consider other project specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.

2.6 The 'ABC method' construction noise level thresholds in BS5228-1 are reproduced in Table 4-1.

Assessment Category and Threshold Value Period	Threshold Value L_{Aeq} dB(A)		
	Cat. A	Cat. B	Cat. C
Nighttime (2300-0700 hours)	45	50	55
Evenings and Weekends D)	55	60	65
Daytime (0700-1900 hours) and Saturdays (0700-1300 hours)	65	70	75
NOTE 1: A potential significant effect is indicated if the $L_{Aeq, T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq, T}$ noise level for the period increases by more than 3 dB due to site noise. NOTE 3: Applies to residential receptors only.			
A) Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. B) Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values. C) Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values. D) 1900-2300 hours on weekdays, 1300-2300 hours on Saturdays, 0700-2300 hours on Sundays.			

Table 4-1: BS 5228-1 Table E.1

2.7 Baseline noise levels and the relevant BS 5228-1 threshold levels based on the ABC method within the proposed site operating hours are shown for each receptor in Table 4-2.

Receptor	Receptor ID	Baseline noise level	Baseline level rounded to the nearest 5 dB	ABC method threshold level
Echoes Day Nursery	NVSR1	60	60	65
Weston Halls Student Accommodation	NVSR2	57	60	65
Ibis Hotel	NVSR3	60	60	65
Princess Street residential buildings	NVSR4	68	70	70
Granby Row residential buildings	NVSR5	59	60	65
Pariser Building and James Lighthill Building (University of Manchester)	NVSR6	66	65	65

Receptor	Receptor ID	Baseline noise level	Baseline level rounded to the nearest 5 dB	ABC method threshold level
John Garside Building and George Begg Building (University of Manchester)	NVSR7	59	60	65
Weston and Pendulum Phase A	NVSR8	< 55 at upper floors	55	65

Table 4-2: Derivation of BS 5228-1 threshold levels

3. Assumed construction activities and source noise data

3.1 At this stage, full details of the plant and proposed activities associated with the works are not yet known. Detailed development phasing is also yet to be developed. Assumptions regarding construction activities and on-times are based on an outline CEMP prepared by the contractor, along with Apex's experience of similar developments. These assumptions have been reviewed by the contractor and amended as required.

3.2 Predictions are carried out for the following phases of construction, for Phase A and Phase B:

- Site preparation (including demolition)
- Substructure works, and
- Superstructure works and general construction

3.3 A more detailed assessment will be undertaken at a later stage once detailed construction method statements are available. A Construction Environmental Management Plan (CEMP) will be submitted to Manchester City Council (MCC) for each phase of development.

3.4 Table 4-3 details the assumed plant types, quantities and utilisation rates used in the construction noise level calculations for site construction work phase. Also presented are the source noise levels (including associated references) that have been applied for each plant item.

3.5 Construction plant noise source data has been taken from BS 5228-1. Noise data for a mast climber used for façade access has been taken from the outline CEMP for the development; however, no reference is available for this noise data, so the predicted levels from this source should be treated with caution. The mast climber does not

significantly affect the predicted noise level, except in some cases where the magnitude of change is negligible.

Construction phase	Plant description	Number of items	L_{Aeq} @10m (dB)	BS 5228 Table ref.	Duration on-time %
Site Preparation Works	Breaking up concrete: Breaker mounted on wheeled backhoe	1	92	C.1 #1	50
	Pulveriser mounted on excavator (30t)	1	76	C.1 #4	80
	Clearing site: Tracked excavator (14t)	2	70	C.2 #7	50
	Distribution of material: Dump truck (tipping fill)	2	79	C.2 #30	40
	Distribution of material: Dump truck (empty)	2	87[1]	C.2 #31	40
	Loading lorries: Wheeled loader	1	79	C.2 #26	10
	Distribution of material: Lorry	1	80[1]	C.2 #34	20
	Breaking up concrete: Hand-held pneumatic breaker	1	83	C.1 #6	20
	Sweeping and dust suppression: Road sweeper	1	76	C.4 #90	40
	Power for site cabins: Diesel generator	1	65	C.4 #83	100
Substructure Works	Clearing site: Tracked excavator (14t)	1	70	C.2 #7	50
	Pumping concrete: Concrete pump + concrete mixer truck (idling)	1	75	C.4 #26	50
	Poker vibrator	1	78	C.4 #33	50
	Waste delivery vehicles: Skip wagon	2	78	C.8 #21	60
	Distribution of material: Dump truck (tipping fill)	1	79	C.2 #30	40
	Distribution of material: Dump truck (empty)	2	87[1]	C.2 #31	40
	Breaking up concrete: Hand-held pneumatic breaker	1	83	C.1 #6	20
	Angle grinder (grinding steel)	1	80	C.4 #93	25
	Continuous flight auger piling – cast in situ: Crawler mounted rig	1	79	C.3 #21	50
	Vibratory piling rig	1	88	C.3 #8	50

Construction phase	Plant description	Number of items	L_{Aeq} @10m (dB)	BS 5228 Table ref.	Duration on-time %
	Craneage for piling (lifting piles, casings, etc): Tracked mobile crane	1	70	C.3 #29	50
	Continuous flight auger piling – cast in situ: Concrete pump	1	75	C.3 #26	50
	Sweeping and dust suppression: Road sweeper	1	76	C.4 #90	40
	Power for site cabins: Diesel generator	1	65	C.4 #83	100
Superstructure Works and General Construction	Lifting: Tower Crane (22t)	1	76	C.4 #48	50
	Lifting: Lifting platform (idling)	1	63	C.4 #58	30
	Façade access: Mast Climber	1	79	N/A	50
	Distribution of materials: Wheeled excavator	1	66	C.4 #10	50
	Spreading chipping / fill: Dozer	1	77	C.5 #12	25
	Paving: Asphalt paver (+ tipper lorry)	1	75	C.5 #30	60
	Rolling and compaction: Vibratory roller	1	80[1]	C.5 #19	50
	Distribution of material: Dump truck (tipping fill)	1	79	C.2 #30	50
	Concrete batching plant	1	80	D.6 #10	75
	Loading lorries: Wheeled loader	1	79	C.2 #26	50
	Clearing site: Wheeled backhoe loader	1	68	C.2 #8	50
	Ground excavation / earthworks: Tracked excavator	1	76	C.2 #15	50
	Mixing concrete: Cement mixer truck (discharging)	1	75	C.4 #18	25
	Pumping concrete: Concrete pump + cement mixer truck (discharging)	1	67	C.4 #24	25
	Sweeping and dust suppression: Road sweeper	1	76	C.4 #90	25
	Power for site cabins: Diesel generator	1	65	C.4 #83	100

[1] Drive-by maximum sound pressure level in L_{Amax}

Table 4-3: Assumed construction techniques and on-times

4. Calculation details

4.1 Calculations have been carried out for the nearest receptors sensitive to construction noise in each direction from the site within the study area. Construction noise levels will be lower at other receptors within the study area, as these are further from the site and will benefit from screening by intervening buildings.

4.2 Calculations assume that all plant items for each construction working scenario are located at the closest point of the closest phase of development to the receptor, or at a minimum of 10 m if the distance from the site boundary to the receptor is less than this distance. In practice, the construction activities during a particular phase will be distributed around the site, so this assessment represents a worst-case scenario.

4.3 The BS 5228-1 calculation method only applies where the distance between the construction activity and receptor is at least 25 m. There is therefore greater uncertainty associated with predicted noise levels at receivers closer than 25 m from the source, particularly where the distance is less than 10 m. The calculated noise levels are considered to indicate the likely magnitude of change, but will need to be refined once construction methodologies are finalised. For works very close to sensitive receptors, testing of potential construction methodologies may be advisable to assist with selecting construction techniques to minimise noise impacts.

4.4 Hard ground is assumed for all calculations. Receiver positions with minimal screening are assumed. Elevated sources are assumed to be at an equal height to the receiver. Table 4-4 details the receiver heights and screening corrections assumed in the calculations.

Receptor	Phase A			Phase B		
	Horizontal distance from works, m	Receiver height, m	Screening corrections applied, dB	Horizontal distance from works, m	Receiver height, m	Screening corrections applied, dB
NVSR1	50	1.5	20 dB to all site preparation and substructure works due to screening from the Weston Halls building. 20 dB to ground level activities for general construction works, 5 dB for elevated works.	N/A		
NVSR2	10	4	No screening assumed as upper floor windows will overlook the site	N/A		
NVSR3	80	18	15 dB to all site preparation and substructure works due to screening from the Weston Halls building. 15 dB to ground level activities for general construction works, 5 dB for elevated works.	10	4	No screening assumed as upper floor windows will overlook the site.
NVSR4	125	25	5 dB to all site preparation and substructure works due to screening from the Weston Halls building. 5 dB to ground level activities for general construction works, 0 dB for elevated works.	45	4	No screening assumed as upper floor windows will overlook the site.
NVSR5	65	18	No screening assumed as upper floor windows will overlook the site	65	18	No screening assumed as upper floor windows will overlook the site.

Receptor	Phase A			Phase B		
	Horizontal distance from works, m	Receiver height, m	Screening corrections applied, dB	Horizontal distance from works, m	Receiver height, m	Screening corrections applied, dB
NVSR6	16	4	No screening assumed as upper floor windows will overlook the site	50	1.5	10 dB screening by site hoardings or Phase A building for ground level activities. No screening assumed for elevated activities
NVSR7	35	4	No screening assumed as upper floor windows will overlook the site	10	4	No screening assumed as upper floor windows will overlook the site
NVSR8	N/A			10	4	No screening assumed as upper floor windows will overlook the site

Table 4-4: Construction noise calculation details

5. Results

5.1 Table 4-5 sets out the construction noise levels calculated for each construction phase at each adopted receptor. The noise levels presented are a worst case with all construction activities occurring at the site boundary, which is unlikely to occur in practice, or would only occur for a short period of time.

5.2 Some calculated noise levels exceed the trigger values for noise insulation and rehousing defined in Section E.4 of BS 5228-1; however, these requirements only occur if the activity occurs "f*or a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months",* which is considered unlikely. Once construction methodologies and durations are further developed, the potential impact should be reassessed.

5.3 The degree by which the construction noise criteria would be complied with or exceeded has been determined, as detailed in Table 4-6.

5.4 Table 4-7 presents a summary of the predicted magnitude of change at each of the receptors, based on the magnitude of change assessment criteria.

Receptor	Calculated Construction Noise Level (dB L_{Aeq})					
	Phase A			Phase B		
	Site Preparation	Substructure Works	Superstructure Works and General Construction	Site Preparation	Substructure Works	Superstructure Works and General Construction
NVSR1	56	53	59	N/A		
NVSR2	90	87	84	N/A		
NVSR3	52	54	56	90	87	84
NVSR4	63	60	59	77	74	72
NVSR5	73	71	68	73	71	68
NVSR6	86	83	80	66	63	65
NVSR7	79	76	74	90	87	84
NVSR8	N/A			90	87	84

Table 4-5: Predicted 'worst' case construction noise levels

Receptor	Degree of exceedance, dB					
	Phase A			Phase B		
	Site Preparation	Substructure Works	Superstructure Works and General Construction	Site Preparation	Substructure Works	Superstructure Works and General Construction
NVSR1	-9	-12	-6	N/A		
NVSR2	25	22	19	N/A		
NVSR3	-13	-11	-9	25	22	19
NVSR4	-12	-15	-16	2	-1	-3
NVSR5	8	6	3	8	6	3
NVSR6	16	13	10	-4	-7	-5
NVSR7	14	11	9	25	22	19
NVSR8				25	22	19

Table 4-6: Construction noise exceedance of ABC criterion

Receptor	Magnitude of change					
	Phase A			Phase B		
	Site Preparation	Substructure Works	Superstructure Works and General Construction	Site Preparation	Substructure Works	Superstructure Works and General Construction
NVSR1	Negligible	Negligible	Negligible	N/A		
NVSR2	Large	Large	Large	N/A		
NVSR3	Negligible	Negligible	Negligible	Large	Large	Large
NVSR4	Negligible	Negligible	Negligible	Medium	Small	Negligible
NVSR5	Large	Large	Medium	Large	Large	Medium
NVSR6	Large	Large	Large	Negligible	Negligible	Negligible
NVSR7	Large	Large	Large	Large	Large	Large
NVSR8	N/A			Large	Large	Large

Table 4-7: Magnitude of change due to construction noise

Appendix 14.5 Details of the construction traffic noise assessment

1. Introduction

1.1 This appendix provides details of the construction traffic assessment for the proposed development.

2. Calculation details

2.1 For each road on the proposed construction traffic route, the change in basic noise level (BNL) due to construction traffic has been calculated. The Annual Average Weekday Traffic (AAWT), defined over an 18-hour day from 0600 to 2400 hours is used in the assessment, following guidance in CRTN.

2.2 For Sackville Street and Princess Street, the CRTN methodology described below is used to calculate the BNL. This methodology is only suitable for roads with traffic flows over 1,000 vehicles per 18-hour day.

2.3 The 18-hour BNL $L_{A10,18h}$ for these roads is calculated using the linear equation for Chart 3 of CRTN, reproduced in Equation 3 below. This equation is empirically derived and depends upon the traffic flow Q:

Equation 3: $$L_{10,18hr} = 29.1 + 10\log_{10} Q$$

2.4 This BNL is adjusted by a correction C to account for variations in mean traffic speed (V) and the percentage of HDVs (p) using the empirically derived equation in Chart 4 of CRTN, as given by Equation 4 below.

Equation 4: $$C = 33\log_{10}\left(V + 40 + \frac{500}{V}\right) + 10\log_{10}\left(1 + \frac{5p}{V}\right) - 68.8$$

2.5 Where the traffic flow Q is between 1,000 and 4,000 vehicles per day, this level is subject to further correction K, calculated for an assumed slant distance d' = 10 m, using Equation 5:

Equation 5: $$K = -16.6\left(\log_{10}\left(\frac{30}{d'}\right)\right)\left(\log_{10}\left(\frac{Q}{4000}\right)\right)^2$$

2.6 Charles Street does not meet the CRTN method minimum traffic flow criterion. For this road, the Noise Advisory Council (NAC) 'A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level Leq'1 method has been used.

[1] The Noise Advisory Council. A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq} 1978

2.7 Prediction of the L_{eq} for road traffic noise is calculated using Equation 15 of the NAC guidance (Equation 6 below), where T is the period of interest in seconds and N is the total vehicle flow. The values for L_{AX1} and L_{AX2} for light and heavy vehicles, respectively, can be obtained from Figure 4.1.4 of the NAC guidance, reproduced in Figure 5-1 below.

Equation 6: $$L_{eq} = 10log_{10}\left(\frac{1}{T}\frac{N}{100}\left[p.10^{\frac{L_{AX2}}{10}} + (100-p)10^{\frac{L_{AX}}{10}}\right]\right)$$

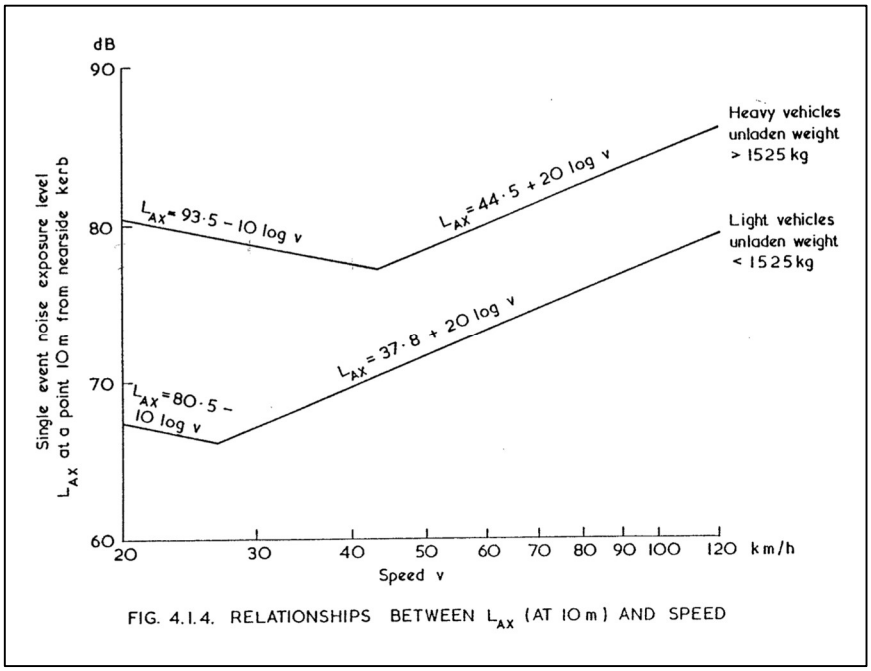


Figure 5-1: L_{AX1} and L_{AX2} values from NAC Guidance

3. Assessment and results

3.1 Baseline traffic data and peak daily construction traffic flows have been provided for the assessment by the project transport consultant.

3.2 Table 5-1 summarises the traffic flow data used in the assessment and the predicted noise level change for each road forming part of the proposed construction traffic route.

3.3 The BNL change for all construction traffic routes is less than 1.0 dB. The magnitude of change is therefore negligible.

Road	Baseline		Peak construction			Noise level change, dB
	Total traffic flow AAWT	%HDV	Peak daily construction traffic flows (HDV)	Total traffic flow AAWT	%HDV	
Sackville Street	1879	1.6	50 (34)	1929	3.3	0.8
Charles Street	873	6.4	50 (34)	923	9.8	0.2
Princess Street	6723	3.0	50 (34)	6773	3.5	0.7

Table 5-1: Calculated noise level change due to construction traffic

Appendix 14.6: Details of construction vibration assessment

1. Vibration assessment

1.1 This section provides details of the construction vibration assessment. Calculations of vibration levels from vibratory sheet piling are carried out based on the following BS 5228-2 methodology:

1.2 Vibration levels from vibratory piling are estimated according to the empirical prediction formula in Annex E of BS 5228-2. The prediction equation for a nominal hammer energy of 1.2 ≤ W ≤ 10.7 kJ is:

$$v_{res} = \frac{k_v}{x^{\delta}}$$

Where:

- v_{res} is the resultant PPV vibration level in mm/s
- x is the distance measured along the ground surface in metres (between 1 and 100 m)
- k_v is a scaling factor relating to the probability of the PPV vibration level being exceeded and is taken as k_v = 126 for this assessment, relating to a 33 % probability of the resulting vibration level being exceeded, and
- δ is a parameter representing the operating condition, and is taken as 1.3 for this assessment to represent 'all operations'.

1.3 Distances for the vibration assessment are taken from the closest point of the Phase A and Phase B building footprints to each sensitive receptor.

1.4 Table 6-1 below presents predicted vibration levels. The magnitude of change for the assessment on people is summarised in Table 6-2.

1.5 The magnitude of change for the assessment on structures is summarised in Table 6-3.

Receptor	Distance to nearest part of proposed building footprint, m		Predicted vibration level v_{res}, PPV, mm/s	
	Phase A	Phase B	Phase A	Phase B
NVSR1	70	N/A	0.5	N/A
NVSR2	5	N/A	15.5	N/A
NVSR3	85	4	0.4	20.8
NVSR4	130	50	0.2	0.8
NVSR5	70	70	0.5	0.5
NVSR6	20	60	2.6	0.6
NVSR7	30	55	1.5	0.7
NVSR8	N/A	12	N/A	5.0
NVSR9	20	60	2.6	0.6
NVSR10	17	17	3.2	3.2

Table 6-1: Calculated construction vibration levels

Receptor	Magnitude of change	
	Phase A	Phase B
NVSR1	Small	N/A
NVSR2	Large	N/A
NVSR3	Small	Large
NVSR4	Negligible	Small
NVSR5	Small	Small
NVSR6	Medium	Small
NVSR7	Medium	Small
NVSR8	N/A	Medium

Table 6-2: Magnitude of change of construction vibration effects on people

Receptor	Magnitude of change	
	Phase A	Phase B
NVSR1	Negligible	N/A
NVSR2	Medium	N/A
NVSR3	Negligible	Medium
NVSR4	Negligible	Negligible
NVSR5	Negligible	Negligible
NVSR6	Negligible	Negligible
NVSR7	Negligible	Negligible
NVSR8	N/A	Negligible
NVSR9	Negligible	Negligible
NVSR10	Negligible	Negligible

Table 6-3: Magnitude of change of construction vibration effects on structures