

# Cambridge Halls, Manchester

## Construction Noise and Vibration Impact Assessment

28<sup>th</sup> February 2025



Prepared for:

Unite

Project Reference:

24127

Document Reference:

24127-HEY-XX-XX-T-Y-5001

Revision:

P03



## Status / Revisions

| Revision | Date       | Status | Author | Reviewer |
|----------|------------|--------|--------|----------|
| P01      | 20/12/2024 | S3     | OS     | JW       |
| P02      | 22/01/2025 | S3     | OS     | JW       |
| P03      | 28/02/2025 | S3     | OS     | JW       |

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# 1. Executive Summary

## Project Overview

Heyda Ltd has been commissioned by Unite to conduct a construction noise and vibration impact assessment for the proposed re-development of the existing Cambridge Halls at 41 Cavendish Street, Manchester, M15 6TT, to provide new student accommodation (PBSA). This report has been prepared to support the ES Chapter for the proposed development and the associated planning application process.

## Objectives and Compliance

The primary objective of this assessment is to evaluate the potential noise and vibration impacts of construction activities on nearby sensitive receptors and recommend appropriate mitigation strategies to minimise disruption. The report has been prepared in accordance with BS 5228:2009+A1:2014, Noise and Vibration Control on Construction and Open Sites, ensuring compliance with local planning conditions and national standards.

## Methodology

The assessment has set construction noise and vibration thresholds based on BS 5228 guidance. A 3D noise model using the ISO 9613-2:2024 methodology has been developed to predict noise levels at the nearest receptors for each phase of construction. Similarly, vibration impacts were predicted using data from BS 5228 and the Federal Transit Administration's (FTA) vibration assessment guide. These predictions consider the proximity of sensitive receptors, expected equipment usage, and site layout.

## Impact Assessment

- **Noise:** Predicted construction noise levels are in many instances within acceptable thresholds at most sensitive receptors, however there are instances where the "significant effect" thresholds are expected to be exceeded. This is predominantly down to the short distances between the site and sensitive receptors.
- **Vibration:** Predicted vibration levels are within the thresholds for significant adverse effects and cosmetic damage at all private residential receptors. With reference to the nearest PBSA residences and educational buildings, the threshold for significant adverse effects is expected to be exceeded when vibratory rollers operate at the site boundaries. These exceedances should be tolerable if prior warning is given to the building occupants.

## Mitigation Strategies

The assessment outlines a comprehensive set of mitigation measures following Best Practicable Means (BPM), including:

- Use of quieter, modern construction equipment.
- Application of site hoarding and acoustic barriers to reduce noise propagation.



- Scheduling noisy activities during agreed working hours.
- Continuous monitoring of noise and vibration to ensure compliance with thresholds.

### **Monitoring and Compliance**

A robust noise and vibration monitoring strategy has been proposed, including the use of continuous monitors at key locations. Real-time monitoring and alerts will enable proactive management of any threshold exceedances, ensuring that mitigation measures are adjusted promptly.

### **Community Liaison and Communication**

The report underscores the importance of community engagement. The contractor is encouraged to implement a community liaison strategy, including:

- Regular updates to local residents, building occupants and stakeholders.
- A dedicated enquiry line for complaints or questions.
- Advanced notice of high-impact construction activities. This proactive approach will foster transparency and maintain positive relationships with the surrounding community.

### **Conclusion**

This noise and vibration impact assessment concludes that, with the recommended mitigation measures, continuous monitoring, and community liaison strategies in place, the proposed development will effectively manage potential noise and vibration impacts. The outlined measures will support the successful and responsible delivery of the development.



## **2. Introduction**

Heyda Ltd has been commissioned to conduct a construction noise and vibration impact assessment for the proposed re-development of the existing Cambridge Halls at 41 Cavendish Street, Manchester, M15 6TT, to provide new student accommodation (PBSA), on behalf of Unite and Manchester Metropolitan University (MMU).

The assessment presented herein complies with the provisions of BS 5228:2009, Code of Practice for Noise and Vibration Control on Construction and Open Sites, and provides full details of proposed construction activities and mitigation measures to protect nearby sensitive receptors.

This document includes an overview of the site setting and surroundings, proposed construction methodologies, and associated potential impacts, alongside mitigation measures to ensure noise and vibration levels remain within acceptable thresholds. Best Practicable Means (BPM) will be employed throughout the construction process to minimise impacts on the surrounding community.

A glossary of technical terminology is provided in Appendix A for information purposes.

### 3. Policy, Standards and Guidance Documents

The noise and vibration impact assessment for the proposed re-development of Cambridge Halls, Manchester has been prepared in line with the following key legislative and policy documents, which form the basis for the assessment methodology and mitigation measures:

- **Planning and Noise – Technical Guidance, Manchester City Council 2022:** Provides advice on addressing noise in planning contexts to promote good acoustic design, aiming for new developments to achieve high standards and minimise impact on surrounding communities, promoting effective planning and mitigation strategies to protect health and well-being.
- **British Standard BS 5228:2009+A1:2014 'Noise and Vibration Control on Construction and Open Sites':** Provides comprehensive guidance on assessing, managing, and mitigating noise and vibration on construction sites. It includes thresholds for noise and vibration, methodologies for assessment, and source noise data for construction activities, serving as a crucial reference for ensuring that impacts are kept within acceptable limits.
- **Control of Pollution Act 1974, Section 61:** Provides the legal framework by which contractors can apply for prior consent to manage potential noise and vibration impacts from construction activities. Applying for consent under this section offers protection against enforcement actions under Section 60 of the Act.
- **Control of Pollution Act 1974, Section 60:** Sets out the conditions under which local authorities may serve notices to control noise from construction sites, specifying permissible noise levels and times of operation.
- **Control of Pollution Act 1974, Section 72:** Defines the Best Practicable Means (BPM) necessary for minimising noise and vibration during construction. BPM involves employing the most suitable mitigation techniques available that are practical and cost-effective.
- **Federal Transit Administration's Transit Noise and Vibration Impact Assessment Manual, May 2006:** Provides additional guidance on predicting and assessing noise and vibration impacts, particularly for projects involving complex construction phases or sensitive receptors, offering criteria for impact severity and mitigation.

These documents collectively inform the methodologies employed in this assessment, guiding the development of effective strategies to mitigate noise and vibration and ensure the project aligns with both local policies and national legislation. This approach ensures that the impacts on the surrounding community are effectively managed and minimised.

## **4. Site Location and Proposed Development**

### **4.1. Site Description**

The Site is located in an urban setting and is surrounded by a mix of land uses including residential properties, commercial, entertainment and educational. Mancunian Way (Ring Road) or the A5103 and A57(M) are situated approximately 100m to the north of the Site. To the west are other PBSA blocks and Barracks. Manchester Metropolitan University educational buildings are located to the east. Entertainment venues in the form of The Salutation Pub and the Manchester Metropolitan University Union are located to the south of The Site. The site falls under the jurisdiction of Manchester City Council (MCC).

The surrounding area features a range of sensitive receptors, primarily comprising of PBSA residences, MMU educational buildings and some private residences, which have been identified and considered in the subsequent noise and vibration assessment. The receptors listed below have been selected as the nearest and most representative of each building use type, ensuring a focused and relevant analysis of potential impacts:

#### **Private Residential:**

- North-west of the site: Residential dwellings at Elmdale Walk, Matham Walk, Loxford Street
- West of the site: 44 Cavendish Street, Dalesman Walk, 71 Cavendish St, The Old Bank

#### **PBSA Residences:**

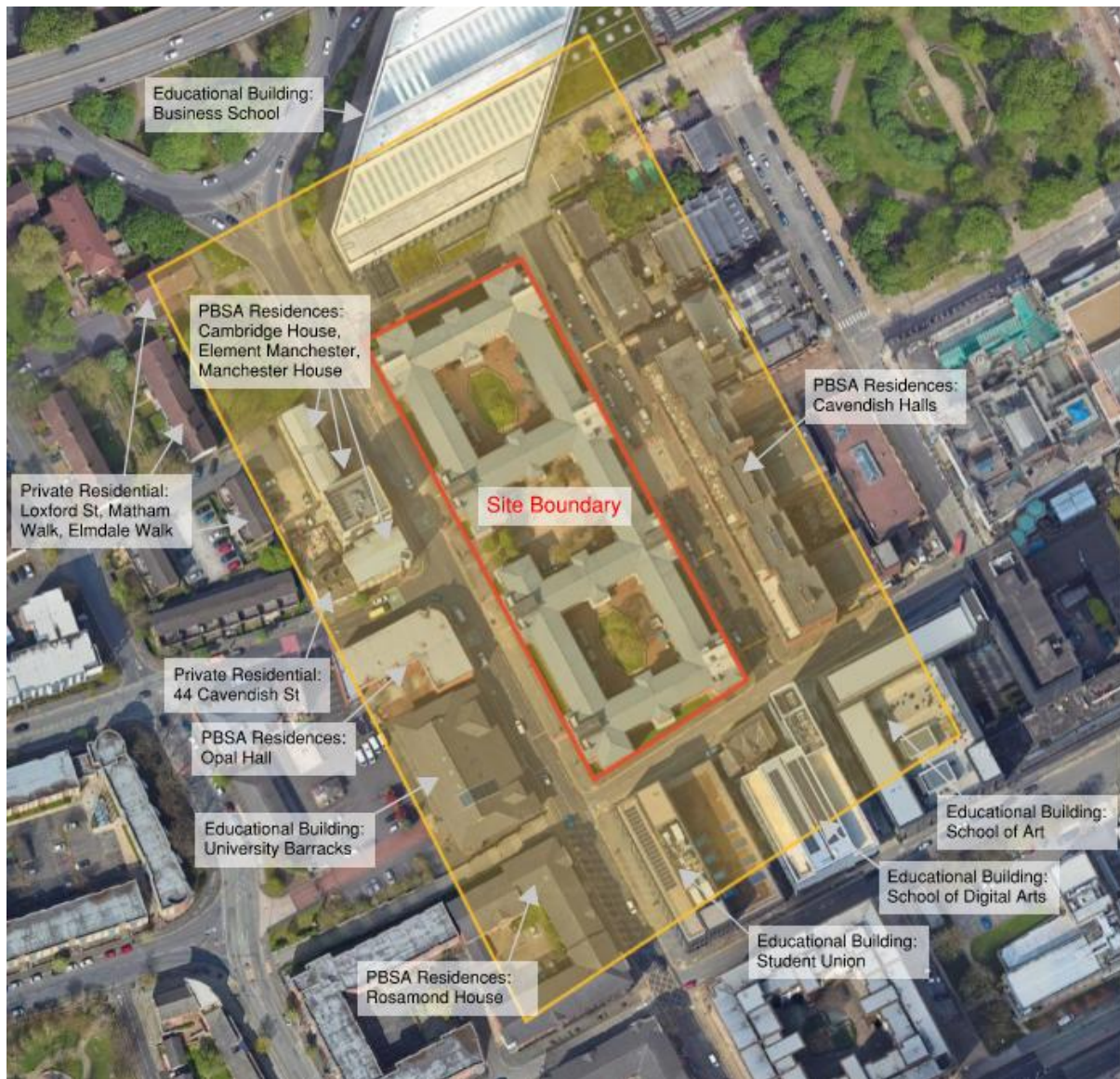
- West of the site: Cambridge House, Element Manchester, Manchester House, Opal Hall, Rosamond House
- East of the site: Cavendish Hall

#### **MMU Educational Buildings:**

- West of the site: University Barracks
- South of the site: Student Union Building, School of Digital Arts, School of Art
- North of the site: Business School

A visual representation of the site and its surroundings, including the nearest sensitive receptors, is illustrated in Figure 1 below.

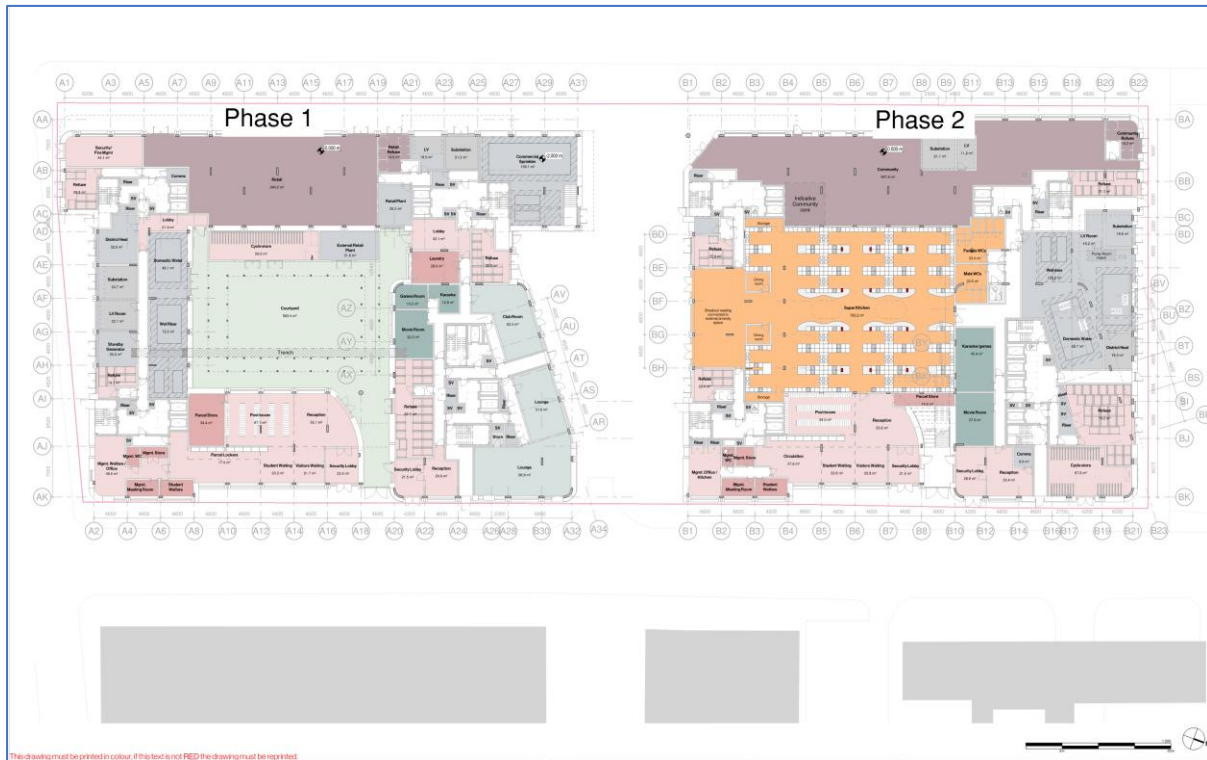
**Figure 1: Site Location and Nearest Noise-sensitive Receptors**



## 4.2. Proposed Development

The proposed development involves the demolition of the existing buildings and the construction of new student residences. The proposals consist of two separate blocks, referred to as Phase 1 and Phase 2, that will be 23 and 29-storeys high, respectively. Each block will predominantly comprise student residences in the form of shared clusters and individual studios, along with communal amenities such as reception areas, lounges, gyms, games rooms, a shared kitchen, building services and management areas and more. The proposed ground floor GA layout of the proposed development, indicating the location of Phases 1 and 2, is illustrated in Figure 2 below:

**Figure 2: Proposed Ground Floor GA Layout**



Based on information provided by the Client and the proposed construction programme, the following primary construction phases have been assumed:

- P1: Demolition of Existing Buildings
- P2A: Phase 1 Block Substructure (Piling mat installation)
- P2B: Phase 2 Block Substructure (Piling mat installation)
- P3A: Phase 1 Block Substructure (Piling)
- P3B: Phase 2 Block Substructure (Piling)
- P4: Construction (Superstructure)
- P5: Construction (Building Envelope)
- P6: Construction (Internal Fit-out)

The schedule of assumed construction plant/machinery/activities, used as a basis of this assessment, is detailed in Appendix B of this report. These have been assumed based on our experience of previous projects; there is no Contractor employed on the scheme at this stage and therefore it is recommended that these assumptions are updated, and a revised assessment be carried out once the proposed plant types, numbers, and on-times are confirmed by the Contractor.

## 5. Construction Noise Impact Assessment

### 5.1. Assessment Method

An assessment has been conducted to predict construction noise emissions at the nearest noise-sensitive receptors in accordance with BS 5228-1:2009+A1:2014. The method comprises the following steps:

1. Identify appropriate construction noise thresholds at which significant adverse effects may occur, at which an offer of noise insulation would be required, and at which temporary/permanent rehousing may be necessary.
2. Identify suitable source noise levels, based on the plant information provided by the contractor, by referencing the noise level database in BS 5228.
3. Construct a 3D noise model and insert the plant noise sources in appropriate locations, representative of the likely worst-case scenario.
4. Predict the construction noise levels, using the 3D noise model, at the nearest noise sensitive receptors in accordance with ISO 9613.
5. Compare the predicted noise levels against the various noise thresholds.
6. Determine whether mitigation measures are required to protect nearby receptors from construction noise.
7. Conclude on the significance of the predicted noise levels once accounting for the proposed mitigation measures.

### 5.2. Working Hours

It is understood that all works will be carried out during normal daytime hours only, with the following proposed construction working hours:

- 07.30 – 18.00 Monday to Friday
- 08.30 – 14.00 Saturdays

No works are proposed to be carried out on Sundays or Bank Holidays.

### 5.3. Construction Noise Thresholds

BS 5228 presents different noise thresholds, exceedance of which triggers different responses. These are as follows:

1. **Significant Effect:** BS 5228 provides the “ABC method” and the “5 dBA change method” which are used to define the construction noise level above which significant effect could occur at a noise sensitive receptor. Where this level is exceeded, it will be essential that Best Practicable Means (BPM) for noise reduction are employed, and community liaison is used to make residents/building users aware of what works are being undertaken and how long they will last.
2. **Noise Insulation:** BS 5228 provides fixed thresholds above which noise insulation should be offered to the occupants of the nearest noise sensitive

receptors. Noise insulation normally comprises secondary glazing with alternative means for ventilation where necessary. This is only applicable to permanently occupied residential dwellings.

3. **Temporary Rehousing:** BS 5228 provides fixed thresholds above which temporary or permanent re-housing should be offered to occupants of the nearest noise sensitive receptors. This is only applicable to permanently occupied residential dwellings.

The thresholds have been established based on the pre-existing ambient noise levels measured on site and surrounding areas by Blackbird Acoustics in support of the wider ES Chapter (report ref. '2124.Rep.20241223.CHM.AAR.Rev1'). The full details of the noise survey can be found in that report, however for simplicity, the measurements relevant to this assessment have been summarised below:

**Table 1: Measured Pre-existing Ambient Noise Levels**

| Blackbird Acoustics Measurement ref. | Location                                                                                            | Measured Daytime $L_{Aeq,16hr}$ dB |
|--------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------|
| Position 1                           | Cambridge Street – representative of any sensitive receptors to the west and north-west of the site | 65                                 |
| Position 2                           | Boundary Street West – representative of any sensitive receptors to the south of the site           | 55                                 |
| Position 3                           | Chatham Street – representative of any sensitive receptors to the east of the site                  | 56                                 |

Based on this rationale, the noise thresholds applicable to the nearest sensitive receptor locations are summarised as follows:

**Table 2: BS 5228 Construction Noise Thresholds at Nearest Noise-sensitive Receptors**

| Receptor                                                             | Measurement Position Used to Establish Significant Effect Threshold | Significant Effect Threshold dB $L_{Aeq, 12hours}$ | Noise Insulation Threshold dB $L_{Aeq, 12hours}$ | Temporary Re-Housing Threshold dB $L_{Aeq, 12hours}$ |
|----------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------|------------------------------------------------------|
| Private residential dwellings to the west and north-west of the site | Position 1                                                          | 70                                                 | 75                                               | 85                                                   |
| PBSA residences west of the site                                     | Position 1                                                          | 70                                                 | 75                                               | 85                                                   |
| PBSA residences east of the site                                     | Position 3                                                          | 65                                                 | 75                                               | 85                                                   |
| Educational buildings west of the site                               | Position 1                                                          | 70                                                 | _*                                               | _*                                                   |
| Educational buildings south of the site                              | Position 2                                                          | 65                                                 | _*                                               | _*                                                   |
| Educational buildings north of the site                              | Position 3                                                          | 65                                                 | _*                                               | _*                                                   |

\*Not applicable to non-residential receptors

An offer of noise insulation or temporary re-housing is only normally required where the threshold is exceeded for 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.

#### 5.4. Construction Plant Noise Levels

The magnitude of the potential impact will depend on the type of activity, period of operation, source to receiver distance, ground absorption and reflections.

Construction noise predictions have been based on the construction plant/machinery/activity likely to be used at the site during each of phase. The sound data for the various construction plant and activities are largely based on sound data from BS5228-1, with all references provided.

The calculations are based on the quantity and a percentage on-time for each plant/machinery/activity. The percentage on-time covers periods when a specified tool, machine or activity is in peak operation. Using the sound power level data from manufacturer data sheets and from BS 5228-1, the total sound power level for each phase of works has been calculated.

Appendix B outlines the construction plant, machinery and activities considered in the assessment, along with the quantity and the expected percentage on-time for each plant/machinery/activity. The assessment should be updated once a Contractor is on board, and the actual plant types are known.

#### 5.5. Noise Model

The construction noise model was developed using the Datakustik Cadna/A software package, applying the ISO 9613-2:2024 noise prediction methodology. This sound propagation model facilitates precise prediction of noise levels at each assessment location, considering critical factors such as geometric spreading, acoustic screening, and reflections.

Based on the construction programme and information provided by the Client, the assessment was segmented into eight primary phases, as outlined in Section 4.2. Noise levels for each phase were modelled using the following methodology:

- **P1 – Demolition:** Predictions for demolition works utilised a single area source covering the site boundary. The source was modelled at an average height of 6m above ground level, approximating the mid-height of the existing buildings. The assigned sound power levels are detailed in Appendix B.
- **P2A and P3A – Phase 1 Block Substructure (piling mat and piling):** Single area sources were used to represent piling mat and piling works separately, situated at a height of 1.5m above ground level and covering the southern half of the site (Phase 1 block). The sound power levels were sourced from Appendix B. Existing building structures were omitted to align with the post-demolition scenario.
- **P2B and P3B – Phase 2 Block Substructure (piling mat and piling):** Similar to Phase 1, separate area sources modelled piling mat and piling works, located at

1.5m above ground level over the northern half of the site (Phase 2 block). The assigned sound power levels are consistent with Appendix B, with building structures excluded to maintain a post-demolition context.

- **P4 – Construction (Superstructure):** This phase assumed concurrent construction of Phases 1 and 2 blocks. A single area source was modelled over the entire site, at an average height of 10m above ground, representative of works on the lower floors where noise thresholds are most likely to be exceeded at nearby receptors. Predictions excluded the built form of the proposed development for a worst-case scenario.
- **P5 – Construction (Building Envelope):** Consistent with superstructure works, a single area source covered the entire site at a 10m height. This phase assumes construction on lower floors, presenting the highest potential impact. Built forms of the proposed development were similarly excluded to ensure a conservative assessment.
- **P6 – Construction (Fit-Out):** Internal fit-out works, anticipated to follow the majority of external construction activities, are not expected to contribute significantly to noise emissions due to containment within the building envelope. Consequently, noise breakout during this phase is deemed negligible, and no further assessment was undertaken.

## 5.6. Noise Level Predictions

### 5.6.1. Private Residential Receptors

The predicted construction noise levels at the worst-affected private residential receptors, located to the west and northwest of the site, are summarised in Table 3.

**Table 3: Predicted Construction Noise Levels – Worst-affected Private Residential Receptors**

| Phase | Predicted Construction Noise Levels dB<br><i>L<sub>Aeq, 12hours</sub></i> | Significant Effect Threshold dB<br><i>L<sub>Aeq, 12hours</sub></i> | Noise Insulation Threshold dB<br><i>L<sub>Aeq, 12hours</sub></i> | Temporary Re-Housing Threshold dB<br><i>L<sub>Aeq, 12hours</sub></i> |
|-------|---------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------|
| 1     | 69                                                                        | 65                                                                 | 75                                                               | 85                                                                   |
| 2A    | 63                                                                        |                                                                    |                                                                  |                                                                      |
| 2B    | 63                                                                        |                                                                    |                                                                  |                                                                      |
| 3A    | 64                                                                        |                                                                    |                                                                  |                                                                      |
| 3B    | 63                                                                        |                                                                    |                                                                  |                                                                      |
| 4     | 68                                                                        |                                                                    |                                                                  |                                                                      |
| 5     | 60                                                                        |                                                                    |                                                                  |                                                                      |

The results indicate that noise levels for the worst-affected private residential receptors—properties at 44 Cavendish Street, Loxford Street, and Matham Walk—will remain below all critical thresholds during most phases. However, during Phases 1 and 4, the Significant Effect Threshold is predicted to be exceeded by up to +4 dBA. Importantly,

neither the Noise Insulation Threshold nor the Temporary Re-Housing Threshold is expected to be breached during any phase of construction.

### 5.6.2. PBSA Residences

Predicted construction noise levels for the worst-affected PBSA residences to the west of the site are provided in Table 4, while those for the east are summarised in Table 5.

**Table 4: Predicted Construction Noise Levels – Worst-affected PBSA Residences West of the Site**

| Phase | Predicted Construction Noise Levels dB L <sub>Aeq</sub> , 12hours | Significant Effect Threshold dB L <sub>Aeq</sub> , 12hours | Noise Insulation Threshold dB L <sub>Aeq</sub> , 12hours | Temporary Re-Housing Threshold dB L <sub>Aeq</sub> , 12hours |
|-------|-------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------|
| 1     | 75                                                                | 70                                                         | 75                                                       | 85                                                           |
| 2A    | 69                                                                |                                                            |                                                          |                                                              |
| 2B    | 69                                                                |                                                            |                                                          |                                                              |
| 3A    | 70                                                                |                                                            |                                                          |                                                              |
| 3B    | 70                                                                |                                                            |                                                          |                                                              |
| 4     | 74                                                                |                                                            |                                                          |                                                              |
| 5     | 66                                                                |                                                            |                                                          |                                                              |

**Table 5: Predicted Construction Noise Levels – Worst-affected PBSA Residences East of the Site**

| Phase | Predicted Construction Noise Levels dB L <sub>Aeq</sub> , 12hours | Significant Effect Threshold dB L <sub>Aeq</sub> , 12hours | Noise Insulation Threshold dB L <sub>Aeq</sub> , 12hours | Temporary Re-Housing Threshold dB L <sub>Aeq</sub> , 12hours |
|-------|-------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------|
| 1     | 74                                                                | 65                                                         | 75                                                       | 85                                                           |
| 2A    | 68                                                                |                                                            |                                                          |                                                              |
| 2B    | 68                                                                |                                                            |                                                          |                                                              |
| 3A    | 69                                                                |                                                            |                                                          |                                                              |
| 3B    | 69                                                                |                                                            |                                                          |                                                              |
| 4     | 73                                                                |                                                            |                                                          |                                                              |
| 5     | 65                                                                |                                                            |                                                          |                                                              |

The PBSA residences west of the site—including Element Manchester, Manchester House, and Opal Hall—are predicted to experience noise levels exceeding the Significant Effect Threshold during Phases 1 and 4 by up to +5 and +4 dBA, respectively. Residences east of the site, including Cavendish Halls, are expected to exceed the Significant Effect Threshold during all phases of construction. However, neither the Noise Insulation Threshold nor the Temporary Re-Housing Threshold is anticipated to be exceeded.

### 5.6.3. Educational Buildings

Predicted construction noise levels for educational buildings surrounding the site are presented in Tables 6–8, representing the west, south, and north locations, respectively.

**Table 6: Predicted Construction Noise Levels – Educational Building West of the Site**

| Phase | Predicted Construction Noise Levels dB<br>L <sub>Aeq</sub> , 12hours | Significant Effect Threshold dB L <sub>Aeq</sub> , 12hours |
|-------|----------------------------------------------------------------------|------------------------------------------------------------|
| 1     | 75                                                                   | 70                                                         |
| 2A    | 69                                                                   |                                                            |
| 2B    | 64                                                                   |                                                            |
| 3A    | 70                                                                   |                                                            |
| 3B    | 65                                                                   |                                                            |
| 4     | 73                                                                   |                                                            |
| 5     | 65                                                                   |                                                            |

**Table 7: Predicted Construction Noise Levels – Educational Buildings South of the Site**

| Phase | Predicted Construction Noise Levels dB<br>L <sub>Aeq</sub> , 12hours | Significant Effect Threshold dB L <sub>Aeq</sub> , 12hours |
|-------|----------------------------------------------------------------------|------------------------------------------------------------|
| 1     | 75                                                                   | 65                                                         |
| 2A    | 70                                                                   |                                                            |
| 2B    | 63                                                                   |                                                            |
| 3A    | 71                                                                   |                                                            |
| 3B    | 64                                                                   |                                                            |
| 4     | 74                                                                   |                                                            |
| 5     | 66                                                                   |                                                            |

**Table 8: Predicted Construction Noise Levels – Educational Buildings North of the Site**

| Phase | Predicted Construction Noise Levels dB<br>L <sub>Aeq</sub> , 12hours | Significant Effect Threshold dB<br>L <sub>Aeq</sub> , 12hours |
|-------|----------------------------------------------------------------------|---------------------------------------------------------------|
| 1     | 75                                                                   | 65                                                            |
| 2A    | 62                                                                   |                                                               |
| 2B    | 71                                                                   |                                                               |
| 3A    | 64                                                                   |                                                               |
| 3B    | 72                                                                   |                                                               |
| 4     | 74                                                                   |                                                               |
| 5     | 66                                                                   |                                                               |

- **West (MMU Barracks):** Noise levels are expected to exceed the Significant Effect Threshold during Phases 1 and 4 by up to +5 and +3 dBA, respectively.
- **South (MMU Student Union and School of Digital Arts):** Exceedances of up to +10 dBA are expected during Phases 1 and 4.
- **North (MMU Business School):** Noise levels, with the exception of Phases 2A and 3A, are expected to exceed the threshold by up to +10 dBA.

### Internal Noise Considerations

Most educational buildings (except MMU Barracks) are equipped with sealed façades and mechanical ventilation systems. With typical glazing providing a noise reduction of 30 dBA, internal noise levels are estimated at 45 dBA or below, even under the highest

external noise conditions. This is unlikely to result in intrusive or disruptive noise levels within these facilities.

#### 5.6.4. Conclusion

While most predicted construction noise levels are within acceptable thresholds, exceedances are anticipated during key phases at specific receptor locations. To manage these impacts:

- Implement best practicable noise reduction measures.
- Maintain effective community liaison to keep affected occupants informed.
- Continuously monitor noise levels to ensure compliance with thresholds.

These measures will help minimise disruption and address any exceedances effectively.

### 5.7. Recommended Noise Mitigation Measures

To justify the predicted noise emissions and ensure compliance during construction, it must be ensured that Best Practicable Means (BPM) are being used to limit noise emissions wherever possible.

Best Practicable Means (BPM) as defined in Section 72 of the Control of Pollution Act 1974, is a key regulatory concept in managing environmental impacts, particularly noise and vibration from demolition sites. BPM is not explicitly defined in terms of specific measures; instead, it emphasises the adoption of all reasonably practicable precautions, considering the current state of technical knowledge and the financial implications of applying various control techniques.

#### Summary of Best Practicable Means

- **Practicability:** This includes the suitability and feasibility of the noise and vibration control measures. It considers what is technically feasible with the available technology and methods.
- **Current Technical Knowledge:** BPM requires the use of the latest technology and methods that are proven to be effective in noise and vibration reduction.
- **Costs and Benefits:** The measures should be cost-effective, meaning the cost of implementing the measure is balanced against the benefit gained from the reduction in noise or vibration.
- **Nature of the Industry:** The specific characteristics and operational requirements of the construction industry are considered. This includes the type of work being carried out and the typical equipment used.

#### Site-Specific Best Practicable Means

The following table presents the list of BPM that must be considered and applied where possible in accordance with BS 5228.

**Table 9: Best Practicable Means for Noise Reduction Applicable to the Proposed Works**

| BPM Measure                                                                                                                          | Applicability to the Works                                                                                                             | Required to be Implemented on Site? |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Use the quietest plant</b> that it is feasible to do so for any given task.                                                       | This is applicable and shall be employed by the Contractor.                                                                            | Yes                                 |
| <b>Use of modern, quieter machinery and technology</b> as part of project planning and implementation.                               | The plant being used should be modern and up-to-date.                                                                                  | Yes                                 |
| <b>Avoid unnecessary revving of engines</b> and switch off equipment when not required.                                              | Applicable to all machinery/plant.                                                                                                     | Yes                                 |
| <b>Maintain internal haul routes</b> well to avoid noise from bumpy or uneven surfaces.                                              | Applicable to primary routes on site used by machinery/plant.                                                                          | Yes                                 |
| <b>Use rubber linings</b> in chutes and dumpers to reduce impact noise.                                                              | Applicable to the dumper trucks.                                                                                                       | Yes                                 |
| <b>Minimise the drop height</b> of materials to reduce noise from impacts.                                                           | Applicable to the dumper trucks.                                                                                                       | Yes                                 |
| <b>Start up plant and vehicles sequentially</b> rather than all together to avoid peak noise levels.                                 | Applicable to all of the main machinery/plant.                                                                                         | Yes                                 |
| <b>Orient noisy plant</b> to direct noise away from sensitive areas.                                                                 | Plant is mobile and not particularly directional and therefore this may not be applicable in this instance.                            | No                                  |
| <b>Use acoustic enclosures</b> for noisy equipment.                                                                                  | Plant is mobile and therefore enclosures will not likely be feasible.                                                                  | No                                  |
| <b>Apply sound-absorbing materials</b> to the inner surfaces of enclosures.                                                          | Enclosures are not proposed as detailed above.                                                                                         | No                                  |
| <b>Manage the movement of plant on site</b> concerning operational hours and proximity to noise-sensitive receptors                  | Primary mobile plant routes/haul roads should be through the centre of the site, rather than around the boundaries wherever possible.  | Yes                                 |
| <b>Alternative reversing warning systems</b> should be used instead of conventional audible alarms to minimise disturbance.          | White noise reverse warning systems should be used wherever possible.                                                                  | Yes                                 |
| <b>Maintenance of machinery</b> should be regular and involve checks for potential noise increases which indicate maintenance needs. | All plant should be regularly checked and maintained.                                                                                  | Yes                                 |
| <b>Increase distance</b> between the noise source and receptors to naturally reduce noise levels.                                    | The plant will need to operate in set locations and therefore increasing distance to the receptors is not possible.                    | No                                  |
| <b>Use of noise barriers and screens</b> to physically block sound paths to receptors.                                               | It is recommended to install a site hoarding around the site, which will reduce noise emissions where plant is used near the boundary. | Yes                                 |

|                                                                                                                                                    |                                                                                                                                                                                                                                                |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Positioning of noise screens or barriers</b> close to either the noise source or the receiver to maximise their effectiveness.                  | All plant is mobile and therefore positioning/moving screening closer to the plant will not be possible.                                                                                                                                       | No  |
| <b>Site layout planning</b> to use natural topography or existing structures to shield noise-sensitive areas.                                      | Works are generally proposed to be carried out by maximising the use of existing structures for acoustic screening. In some instances, however, the works will inevitably have to be carried out in a direct line of sight with the receptors. | Yes |
| <b>Vegetative barriers</b> like trees or shrubs, although more psychological in their effect, can be used to give a perception of noise reduction. | There are no significant existing vegetative barriers and adding any in a short timeframe would not be possible.                                                                                                                               | No  |

In addition to these measures, BS 5228 provides details of community liaison and construction noise monitoring, as detailed in Sections 7 and 8 of this report.

The purpose of the scheme of construction noise monitoring will be to ensure construction works do not exceed the significant effect, as well as the noise insulation or temporary re-housing thresholds at the relevant receptors.

The noise insulation and temporary-rehousing thresholds only apply to residential receptors and after exceedance periods defined as 10 days within any 15 consecutive days, or 40 days within any consecutive 6-month period. If these thresholds are exceeded during these periods, appropriate measures—or reasonable costs thereof—must be offered to affected occupants. This may include the installation of secondary glazing, alternative ventilation in their properties, or temporary re-housing for the duration of the noisy works.

## 5.8. Construction Noise Significance

The predicted demolition noise levels have the potential to cause significant adverse effects at the nearby noise sensitive receptors identified in the assessment. It is therefore essential that BPM are employed to control noise emissions.

Further to the implementation of BPM, and the community liaison and monitoring measures detailed later in this report, the works are **expected to align with BS 5228 and the principle of BPM** and therefore offers of noise insulation or temporary re-housing are not likely to be required.

## 6. Construction Vibration Impact Assessment

### 6.1. Assessment Method

An assessment has been conducted to predict construction vibration emissions at the nearest noise-sensitive receptors in accordance with BS 5228-2:2009+A1:2014. The method comprises the following steps:

1. Identify appropriate vibration thresholds at which significant adverse effects may occur, and at which temporary/permanent rehousing may be necessary.
2. Identify suitable source vibration levels, based on the anticipated plant/machinery, by referencing the vibration level databases in either BS 5228 or the United States (US) Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment Guide ("the FTA Guide").
3. Predict the construction vibration levels at the nearest noise sensitive receptors in accordance with BS 5228 or the FTA Guide.
4. Compare the predicted vibration levels against the vibration thresholds.
5. Determine whether mitigation measures are required to protect nearby receptors from construction vibration.
6. Conclude on the significance of the predicted vibration levels, accounting for the proposed mitigation measures.

### 6.2. Construction Vibration Thresholds

BS 5228 presents different vibration thresholds, exceedance of which triggers different responses. These are as follows:

1. **Significant Effect:** BS 5228 states that a peak particle velocity (PPV) vibration level greater than 1.0 mm/s is likely to cause complaint but can be tolerated in prior warning and explanation has been given to residents.
2. **Upper Limit:** BS 5228 states that a PPV of 10 mm/s is likely to be intolerable for any more than a very brief exposure to this level in most building environments. This is therefore deemed the upper threshold and should not be exceeded.

The applicable vibration thresholds have been selected in accordance with BS 5228 as presented below.

**Table 10: Construction Vibration Thresholds**

| Receptor                                                       | Significant Effect Threshold<br>PPV mm/s | Upper Limit Threshold PPV<br>mm/s |
|----------------------------------------------------------------|------------------------------------------|-----------------------------------|
| Private residential, PBSA residences and educational buildings | 1.0                                      | 10.0                              |

The thresholds are based on human response and therefore the same had been applied to all receptors mentioned in this report.

In addition to the above, BS 5228 also indicates that light cosmetic damage to buildings is possible when vibration levels exceed 15 mm/s at receptor locations, particularly when the buildings are connected. Minor structural damage to residential buildings is typically only expected at levels above 30 mm/s.

## 6.3. Prediction of Vibration Levels

### 6.3.1. Piling Works

It is anticipated that piling works will be required to provide foundations for the proposed development. At present, no information has been provided in relation to the proposed piling method. Given the urban nature of the site, it is recommended that piling works are carried out using the Continuous Flight Auger (CFA) method. While specific vibration prediction methods for CFA piling are limited, this technique is widely recognised as the least intrusive piling method, generating minimal vibration impacts. This makes CFA piling particularly suitable for urban or sensitive environments.

Given the close proximity of the footprints of the proposed buildings—approximately 13 metres from the nearest receptor (MMU School of Digital Arts)—it is essential to ensure that vibration impacts are managed to avoid significant adverse effects, as far as practicable.

BS 5228-2 provides historical data on vibration levels associated with rotary bored piling and augering. Although rotary bored piling generally produces higher vibration levels compared to CFA piling, it can be considered a conservative worst-case scenario for this assessment. The most relevant data from BS 5228-2 is summarised below:

**Table 11: BS 5228-2 Historic Piling Data**

| BS 5228 Ref. | Soil Conditions | Pile Dimensions               | Mode                       | Distance | PPV (mm/s) |
|--------------|-----------------|-------------------------------|----------------------------|----------|------------|
| D.104        | Fill/sand/clay  | 500mm diameter, unknown depth | Augering                   | 10       | 0.4        |
|              |                 |                               | Auger hitting base of hole | 14       | 0.3        |
|              |                 |                               | Mudding in                 | 10       | 0.3        |
|              |                 |                               | Spinning off               | 10       | 0.3        |

With reference to the above table, it can be concluded that at distances of around 13 meters, PPV levels of less than 0.4 mm/s can be expected. This is below the threshold for significant adverse effects, which is considered acceptable, with reference to the operations of a CFA piling rig.

### 6.3.2. Other Works

Table 12 summarises key construction equipment expected to dominate vibration levels in the immediate vicinity of the site boundary. The equipment types, working locations, and activities are based on early stage assumptions (detailed in Appendix B). Source vibration levels for each item of plant were selected from the databases in BS 5228 and the Federal Transit Administration (FTA) guide.

**Table 12: Source Vibration Level for Proposed Plant**

| Equipment Type   | Working location / activity             | Database Reference        | Source Vibration Level PPV mm/s |
|------------------|-----------------------------------------|---------------------------|---------------------------------|
| Vibratory Roller | Piling mat                              | FTA guide                 | 5.3 at 7.6m                     |
| Lorry            | Vehicle entrance and access/haul routes | FTA guide (Loaded Trucks) | 1.9 at 7.6 m                    |
| Excavator        | Across the majority of site             | FTA guide                 | 1.9 at 7.6 m                    |

The construction vibration levels were predicted using the FTA guide methodology, which incorporates simple assumptions for soil damping and geometric dispersion. The results of these predictions are presented in Table 13. The shortest distance from the nearest site boundary to the façade of each receptor type was used to model the vibration levels.

**Table 13: Predicted Construction Vibration Levels at the Nearest Receptors**

| Receptor                             | Distance | Predicted Construction Vibration Levels PPV mm/s |       |           | Significant Effect Threshold PPV mm/s | Temporary Re-Housing Threshold PPV mm/s |
|--------------------------------------|----------|--------------------------------------------------|-------|-----------|---------------------------------------|-----------------------------------------|
|                                      |          | Vibratory Roller                                 | Lorry | Excavator |                                       |                                         |
| Nearest private residential receptor | 40       | 0.5                                              | 0.2   | 0.2       | 1.0                                   | 10.0                                    |
| Nearest PBSA residences              | 17       | 1.6                                              | 0.6   | 0.6       | 1.0                                   | 10.0                                    |
| Nearest educational building         | 13       | 2.4                                              | 0.9   | 0.9       | 1.0                                   | 10.0                                    |

The receptor points for vibration are located within the buildings where occupants would experience the vibration. However, the predictions are based on theoretical free-field receptors, which do not consider the effects of building structure. As the receptor buildings are predominantly large, heavyweight structures, it is likely that vibration levels will decrease as they transmit into the building interiors. These predictions, therefore, represent a conservative worst-case scenario.

### Key Findings:

- Nearest Private Residential:** The predicted vibration levels are well below the significant adverse effect threshold of 1.0 mm/s, reflecting the distance between the proposed site and these receptors. While perceptible vibration may occur at levels of 0.14 mm/s or higher, the predicted vibration levels are considered acceptable.
- Nearest PBSA Residences:** The predicted vibration levels suggest that operations involving vibratory rollers may exceed the significant adverse effect threshold at the nearest façades (including Cambridge House, Element Manchester, Manchester House and Opal Hall), given the short distance of around 17 metres from the nearest

site boundary. This exceedance should be tolerable if prior warning is provided to the occupants.

3. **Nearest Educational Building:** The predicted vibration levels suggest that operations involving vibratory rollers may exceed the significant adverse effect threshold at the nearest façades (MMU School of Digital Arts, Business School, Student Union and University Barracks) given the short distance of just 13 metres from the site boundary. This exceedance should be tolerable if prior warning is provided to the occupants.
4. **Damage Thresholds:** All predicted vibration levels are significantly below the upper threshold of 10 mm/s for temporary re-housing and the levels at which cosmetic damage to structures is likely to occur. Thus, the risk of structural damage to buildings is negligible.

#### Recommendations:

- **Mitigation Measures:** Best Practicable Means (BPM) should be implemented to minimise vibration levels during construction works. Measures may include limiting the use of vibratory rollers near sensitive receptors and optimising working practices to reduce vibration emissions.
- **Community Liaison:** Clear communication with nearby occupants and building users is recommended to provide advance notice of potential vibration levels during critical construction activities.
- **Vibration Monitoring:** Continuous vibration monitoring should be conducted to verify compliance with the predicted vibration levels and ensure adherence to the established thresholds.

By implementing these recommendations, the potential for significant adverse effects on sensitive receptors can be effectively mitigated while maintaining compliance with applicable standards.

## 6.4. Required Vibration Mitigation Measures

To justify the predicted vibration emissions and ensure compliance during construction, it must be ensured that Best Practicable Means (BPM) are being used to limit vibration emissions wherever possible.

The BPM principle for vibration is the same as it is for noise; vibration should be limited wherever practicable.

The following table presents the list of BPM that must be considered and applied where possible in accordance with BS 5228.

**Table 14: Best Practicable Means for Vibration Reduction Applicable to the Proposed Works**

| BPM Measure                                                          | Applicability to the Works                                       | Required to be Implemented on Site? |
|----------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------|
| <b>Use of modern methods which lower vibration emissions as part</b> | <b>The plant being used should be modern and up-to-date. The</b> | <b>Yes</b>                          |

|                                                                                                                                                |                                                                                                                                             |     |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----|
| of project planning and implementation.                                                                                                        | construction methods are understood to be those with the lower vibration emissions, given the relevant constraints on access and programme. |     |
| <b>Isolate vibration at source</b> by installing equipment on anti-vibration mountings where necessary.                                        | Not applicable to mobile plant.                                                                                                             | No  |
| <b>Position vibrating equipment</b> far from sensitive receptors, and not on the same structure as the receptor.                               | Plant must operate where required in this instance which includes the site boundaries.                                                      | No  |
| <b>Remove any known obstructions</b> from the piling locations.                                                                                | Applicable during piling works.                                                                                                             | Yes |
| <b>Mudding in</b> for rotary bored piles. Seat the casing using a twister bar where possible as opposed to tapping or vibrating into position. | It is recommended to carry out piling works using CFA                                                                                       | No  |
| <b>Avoid sheer leg contact</b> with sensitive structures which can transfer vibration directly to the receptor.                                | Not applicable.                                                                                                                             | No  |

In addition to the above measures, BS 5228 recommends community liaison and vibration level monitoring which are detailed further in Sections 7 and 8 of this report.

## 6.5. Construction Vibration Significance

The predicted demolition vibration levels have the potential to cause significant adverse effects at certain PBSA residences (Cambridge House, Element Manchester, Manchester House and Opal Hall) and educational buildings (MMU School of Digital Arts, Business School, Student Union and University Barracks). It is therefore essential that BPM are employed to control vibration emissions.

Further to the implementation of BPM, and the community liaison and monitoring measures detailed later in this report, the works are **expected to align with the BS 5228 guidelines** and therefore offers of additional measures such as temporary re-housing are not likely to be required.

## 7. Community Liaison

Effective co-ordination and time management of construction works is essential in avoiding noise and vibration nuisance to surrounding uses. Early and helpful communications with the surrounding residents and building occupants will assist in reducing the potential for, and in managing, any complaints arising during construction.

Details of the proposed community liaison strategy are provided as follows:

1. **Communication with Nearby Building Occupants:** Contractors are required to ensure that sensitive receptors are kept informed about the activities. This includes providing advance notice of any works that may cause significant disruption due to noise or vibration.
2. **Site Contact Board:** A site contact board must be displayed prominently at the site entrance. This board should include:
  - The name of the main contractor.
  - The address and telephone number where a responsible person can be contacted.
  - The name of the site manager.
  - The expected month and year of completion of the works.
3. **Regular Updates:** The contractor should issue regular updates to affected receptors and other stakeholders about the progress of the work and any changes to the expected schedules or impacts.
4. **Handling Complaints:** A procedure must be in place for handling complaints from the public effectively. This includes recording complaints, actions taken in response, and ensuring timely communication back to the complainant.
5. **Staffed Telephone Line:** There should be a telephone line available at all times during working hours, which can be used by the public to make enquiries or complaints. This line should be manned by staff who are knowledgeable about the project and capable of addressing concerns.
6. **Newsletter:** Contractors are encouraged to issue newsletters, ideally monthly, to keep the local community informed about the project progress, upcoming activities, and other relevant information.

These community liaison requirements are designed to ensure transparency, maintain good relations with the local community, and address any concerns promptly during the construction period.

By implementing the above, the Contractor is demonstrating a commitment to BPM with regards to community liaison.

## 8. Noise and Vibration Monitoring Strategy

### 8.1. Strategy Overview

The following monitoring strategy has been developed and is considered appropriate for this project and in line with Manchester City Council's 2022 Noise and Planning Technical Guidance.

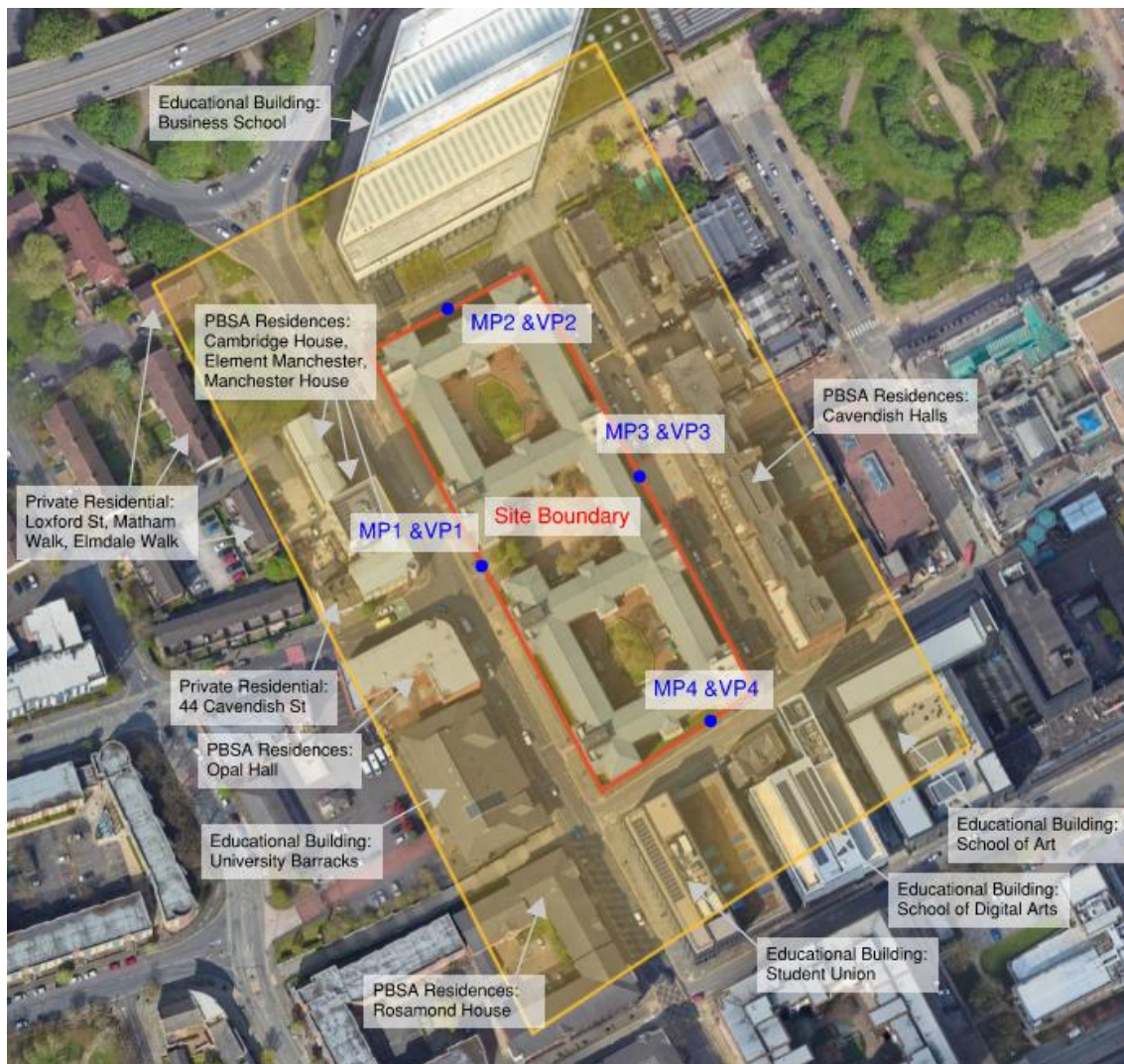
### 8.2. Monitoring Locations

It is recommended that continuous construction noise and vibration monitoring is carried out for the duration of the works at locations representative of the surrounding receptors.

As such, four noise monitors (MP1 – MP4) and four vibration monitors (VP1 – VP4) are recommended as a minimum, in this instance.

The proposed monitoring locations are shown in Figure 3 and described below.

**Figure 3: Proposed Noise and Vibration Continuous Monitoring Position**



## 8.3. Noise and Vibration Limits

### 8.3.1. Noise Limits

Noise levels should not normally exceed 75 dB  $L_{Aeq,12h}$  for the duration of the construction works at any receptors.

Table 15 presents the applicable limits at the recommended noise monitoring locations. A warning alert is recommended where the noise level reaches 5 dB below the noise limit for 1 hour so that the Contractor can check methods and ensure that operations are not expected to exceed the noise limit for the full daytime period.

**Table 15: MP1 Construction Noise Limits and Alerts**

| Measurement Location | Noise Limit dB                |                              |
|----------------------|-------------------------------|------------------------------|
|                      | Warning Alert $L_{Aeq,1hour}$ | Noise Limit $L_{Aeq,12hour}$ |
| MP1 – MP4            | 70                            | 75                           |

If the monitors are installed closer to the works than the receptors then higher limits may be applicable.

### 8.3.2. Vibration Limits

It should be ensured that vibration levels do not exceed a peak particle velocity (PPV) of 10 mm/s as an absolute worst-case. It is recommended that alerts are set to notify the Contractor when they are likely to exceed both 3 mm/s and 5 mm/s.

Table 16 presents the applicable limits at the recommended vibration monitoring location. The Contractor should stop works and inspect the operations being undertaken as soon as exceedances are recorded.

**Table 16: Construction Vibration Limits and Alerts**

| Measurement Location | Vibration Limit PPV mm/s |                 |
|----------------------|--------------------------|-----------------|
|                      | Warning Alert            | Vibration Limit |
| VP1 – VP4            | 3                        | 5               |

As above, if the monitoring position is installed closer to the works than the receptor then higher limits may be applicable.

## 8.4. Monitoring Specifications

Both the noise and vibration monitors should be automatic remote logging systems, collecting noise and vibration data at regular intervals (e.g., every 15 minutes) throughout the monitoring period.

Data should be accessible in real-time and historically through a web-based platform. Noise alert and action levels shall be set up at the limits defined in the previous section. Should noise or vibration levels exceed these thresholds, emails shall be dispatched to a designated contact list.

A monthly monitoring report should be produced, summarising the measurement results from each location and comparing them against established baselines or limits.

Where the measured noise levels are more than the predicted noise levels or in the event of a complaint of noise an investigation shall be carried out to ascertain the cause of the



exceedance or the complaint and to check that Best Practicable Means are being used to control the noise in accordance with the steps set out in this report. Noise levels shall be reduced further if it is reasonably practicable to do so.

A similar procedure should be applied to the vibration measurements.

The Contractor shall carry out these investigations and report back to the monitoring team to confirm the reason for exceedance, and the measures put in place to rectify the situation.



## 9. Conclusion

Heyda Ltd has been commissioned to conduct a construction noise and vibration impact assessment for the proposed re-development of the existing Cambridge Halls at 41 Cavendish Street, Manchester, M15 6TT, to provide new student accommodation (PBSA), on behalf of Unite and Manchester Metropolitan University (MMU).

The assessment has identified appropriate noise and vibration thresholds in line with BS 5228:2009+A1:2014, and has evaluated the likely impacts on nearby sensitive residential and educational receptors. By adopting Best Practicable Means (BPM), including the use of the quietest and most modern construction machinery and techniques, as well as optimised site practices, the proposed construction activities are designed to minimise noise and vibration levels as far as reasonably practicable.

The mitigation strategies detailed in this report—such as robust noise and vibration monitoring, the implementation of effective control measures, and the prioritisation of community engagement—demonstrate a proactive and responsible approach to managing construction impacts. The proposed monitoring framework includes continuous data collection, real-time alerts, and periodic reporting to ensure compliance with the established thresholds.

In conclusion, this assessment confirms that the proposed construction activities, when carried out in accordance with the recommended mitigation measures and monitoring protocols, can be managed effectively to minimise adverse impacts. The adoption of transparent communication strategies and early community engagement will further support the smooth progression of the development while addressing concerns and maintaining positive relationships with local stakeholders.

This report provides assurance that the development is committed to achieving compliance with regulatory standards and safeguarding the well-being of the surrounding community throughout the construction process.

## Appendix A - Glossary of Acoustic Terminology

This glossary provides an overview of key acoustic terms and concepts:

- **Sound:** Vibration of particles in a medium like air, detectable by the human ear. When sound is audible and unwanted or undesirable, it is termed 'noise'.
- **Sound Pressure:** Local pressure fluctuations from the normal pressure caused by the vibration or oscillation of particles. The number of oscillations per second is termed 'frequency'.
- **Frequency:** The rate at which particles oscillate, measured in Hertz (Hz). The human ear can typically detect frequencies from 20 Hz (low bass) to 20,000 Hz (high treble), with varying sensitivity across this range.
- **Sound Pressure Level:** Quantified in decibels (dB), this logarithmic parameter approximates the human ear's response to sound, measuring the ratio of a given pressure to the threshold of hearing.
- **A-Weighted Decibels (dB(A) or dB  $L_{pA}$ ):** A frequency weighting used in sound level meters to mimic the human ear's response, particularly at typical environmental sound pressure levels.
- **Measurement Parameters in Acoustics:**
  - **dB  $L_{Aeq,T}$ :** Equivalent continuous A-weighted sound pressure level over a period, T, representing the energy-average sound pressure.
  - **dB  $L_{AFmax,T}$ :** Maximum A-weighted sound pressure level during a period, T, approximating the ear's time-response.
  - **dB  $L_{A90,T}$ :** The 90th percentile A-weighted sound pressure level, exceeded for 90% of the period, T, often referred to as the background sound level.
- **Sound Level Meters:** Instruments incorporating a microphone to measure sound pressure levels, using frequency filters to approximate the human ear's response.

Tables A1 and A2 in the appendix present sound pressure levels in typical environments and further definitions of acoustic parameters, respectively.

**Table A1: Sound pressure levels within typical environments**

| Sound Pressure Level, dB | Typical Environment or Description                                              |
|--------------------------|---------------------------------------------------------------------------------|
| 0                        | Threshold of hearing                                                            |
| 15 to 25                 | A recording studio                                                              |
| 25 to 35                 | A hotel bedroom at night                                                        |
| 35 to 45                 | An unoccupied office                                                            |
| 45 to 55                 | Quiet residential street                                                        |
| 55 to 65                 | Normal conversation, 1 m away<br>TV programme, listener position                |
| 65 to 75                 | Raised voices, 1 m away<br>Urban high street traffic                            |
| 75 to 85                 | Busy motorway traffic, on hard shoulder<br>Typical small plant room             |
| 85 to 95                 | High-speed hand-dryer, operator position<br>Inside London underground (average) |
| 95 to 105                | Pneumatic hammer, operator position<br>Concert orchestra                        |
| 105 to 115               | Typical nightclub<br>Untreated generator plantroom                              |
| 115 to 140               | Aircraft take-off, close proximity<br>Threshold of pain                         |

**Table A2: Definitions of Acoustic Terminology and Parameters**

| Wording                                                    | Description                                                                                                                                                                                |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A-weighting                                                | A process adjusting observed sound pressure levels across different frequencies to mimic the human ear's sensitivity to sound. Expressed as dB(A).                                         |
| Ambient Sound Level                                        | The total sound pressure level at a specific position from all surrounding noise sources, usually expressed as dB $L_{Aeq,T}$ , the equivalent continuous A-weighted sound pressure level. |
| Best Practicable Means (BPM)                               | The most suitable mitigation techniques available that are practical and cost-effective for minimizing noise and vibration during construction.                                            |
| BS 5228                                                    | British Standard for "Noise and Vibration Control on Construction and Open Sites," providing guidelines for assessing, managing, and mitigating noise and vibration on construction sites. |
| Decibel                                                    | A logarithmic unit measuring sound pressure or power relative to a reference value (20 $\mu$ Pa for sound pressure, $10^{-12}$ W for sound power).                                         |
| Equivalent Continuous Sound Pressure Level ( $L_{Aeq,T}$ ) | A measure of the average sound level over a specified period, representing the energy mean of the sound pressure levels. Often used to describe exposure to noise.                         |
| Noise Insulation                                           | Measures or methods used to reduce the transmission of sound from one area to another, usually involving structural modifications or the use of specific building materials.               |

|                              |                                                                                                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peak Particle Velocity (PPV) | A measure used in the assessment of vibration, indicating the maximum speed of a particle at a point, measured in mm/s, often used to assess potential damage to structures from vibration.    |
| Receptor                     | Locations or individuals receiving or susceptible to environmental impacts like noise or vibration from a construction site.                                                                   |
| Sound Absorption             | The process by which material, structure, or object takes in sound energy when sound waves collide with it, as opposed to reflecting the sound.                                                |
| Sound Power Level            | The total sound energy emitted by a source per unit of time, measured in watts, and often converted to a decibel scale to describe the intensity of the source.                                |
| Sound Pressure Level (SPL)   | The pressure level of sound relative to a reference value, measured in decibels (dB), used to describe the loudness at a specific location.                                                    |
| Substructure                 | The underlying structure forming the foundation of a construction project, involving initial phases like excavation and foundation laying, typically associated with higher vibration levels.  |
| Thresholds                   | Pre-determined levels at which additional actions, such as mitigation or compensation, are required to manage the impact of construction noise or vibration.                                   |
| Vibration Mitigation         | Techniques or measures implemented to reduce the intensity and effects of vibration caused by construction activities, aimed at protecting structures and occupants from discomfort or damage. |

## Appendix B - Construction Plant Details

**Table B.1: Schedule of Proposed Construction Plant – P1 – Demolition**

| Plant/Machinery/Activity                        | Reference (BS 5228 or Makita database) | Sound Power Level (dBA) | Quantity on site | Percentage on-time during a typical day (%) |
|-------------------------------------------------|----------------------------------------|-------------------------|------------------|---------------------------------------------|
| Excavator with high reach demolition attachment | D.2.5                                  | 119                     | 2                | 25                                          |
| Tracked excavator (clearing up)                 | D.3.24                                 | 108                     | 4                | 30                                          |
| Hand-held pneumatic breaker                     | D.2.12                                 | 117                     | 2                | 10                                          |
| Lorry                                           | C.8.20                                 | 107                     | 2                | 15                                          |

**Table B.2: Schedule of Proposed Construction Plant – P2A & P2B – Substructure (Piling Mat Installation)**

| Plant/Machinery/Activity | Reference (BS 5228 or Makita database) | Sound Power Level (dBA) | Quantity on site | Percentage on-time during a typical day (%) |
|--------------------------|----------------------------------------|-------------------------|------------------|---------------------------------------------|
| Tracked Excavator        | D.3.24                                 | 108                     | 2                | 50                                          |
| Vibratory roller         | C.5.20                                 | 103                     | 2                | 50                                          |
| Lorry                    | C.8.20                                 | 107                     | 2                | 15                                          |
| Dumper                   | D.7.88                                 | 106                     | 2                | 15                                          |

**Table B.3: Schedule of Proposed Construction Plant – P3A & P3B – Substructure (Piling Works)**

| Plant/Machinery/Activity | Reference (BS 5228 or Makita database) | Sound Power Level (dBA) | Quantity on site | Percentage on-time during a typical day (%) |
|--------------------------|----------------------------------------|-------------------------|------------------|---------------------------------------------|
| Piling Rig               | C.3.21                                 | 107                     | 1                | 50                                          |
| Tracked Excavator        | D.3.24                                 | 108                     | 2                | 50                                          |
| Telescopic handler       | C.2.35                                 | 99                      | 1                | 20                                          |
| Concrete Pump            | C.3.26                                 | 103                     | 4                | 15                                          |
| Concrete mixer truck     | C.4.28                                 | 103                     | 4                | 15                                          |
| Lorry                    | C.8.20                                 | 107                     | 2                | 15                                          |
| Dumper                   | D.7.88                                 | 106                     | 2                | 15                                          |

**Table B.4: Schedule of Proposed Construction Plant – P4 – Superstructure**

| Plant/Machinery/Activity  | Reference (BS 5228 or Makita database) | Sound Power Level (dBA) | Quantity on site | Percentage on-time during a typical day (%) |
|---------------------------|----------------------------------------|-------------------------|------------------|---------------------------------------------|
| Scaffold frames and clips | D.7.3                                  | 96                      | 2                | 50                                          |
| Scaffold poles and clips  | D.7.2                                  | 100                     | 2                | 50                                          |
| Hand-held hammer          | D.2.15                                 | 112                     | 4                | 50                                          |

|                            |                  |     |   |    |
|----------------------------|------------------|-----|---|----|
| Compressor                 | D.6.19           | 100 | 2 | 50 |
| Electric percussion drill  | D.6.53           | 104 | 4 | 10 |
| Poker vibrator             | D.6.40           | 101 | 2 | 30 |
| Power float                | C.4.33           | 100 | 2 | 30 |
| Concrete pump and boom arm | C.4.30           | 107 | 4 | 15 |
| Concrete mixer truck       | C.4.28           | 103 | 4 | 15 |
| Tower crane                | C.4.48           | 104 | 2 | 40 |
| Telescopic handler         | C.2.35           | 99  | 2 | 20 |
| Impact driver              | Makita<br>BTD147 | 106 | 2 | 5  |
| Lorry                      | C.8.20           | 107 | 2 | 15 |

**Table B.5: Schedule of Proposed Construction Plant – P5 – Building Envelope**

| Plant/Machinery/Activity  | Reference (BS 5228 or Makita database) | Sound Power Level (dBA) | Quantity on site | Percentage on-time during a typical day (%) |
|---------------------------|----------------------------------------|-------------------------|------------------|---------------------------------------------|
| Electric percussion drill | D.6.53                                 | 104                     | 4                | 10                                          |
| Hand-held hammer          | D.2.15                                 | 112                     | 2                | 5                                           |
| Impact driver             | Makita<br>BTD147                       | 106                     | 2                | 5                                           |
| Lifting platform          | C.4.57                                 | 95                      | 4                | 20                                          |
| Material hoist            | C.4.61                                 | 96                      | 2                | 20                                          |
| Tower crane               | C.4.48                                 | 104                     | 2                | 40                                          |
| Lorry                     | C.8.20                                 | 107                     | 2                | 15                                          |