

Cambridge Halls, Manchester

MUGAs and Gyms Noise and Vibration Impact Assessment

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1. Introduction

This technical note presents a noise and vibration assessment to support the proposals for the 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 aim of this technical note is to provide a noise and vibration assessment for the proposed Multi Use Games Areas (MUGAs) and Gymnasium spaces, included as part of the proposals.

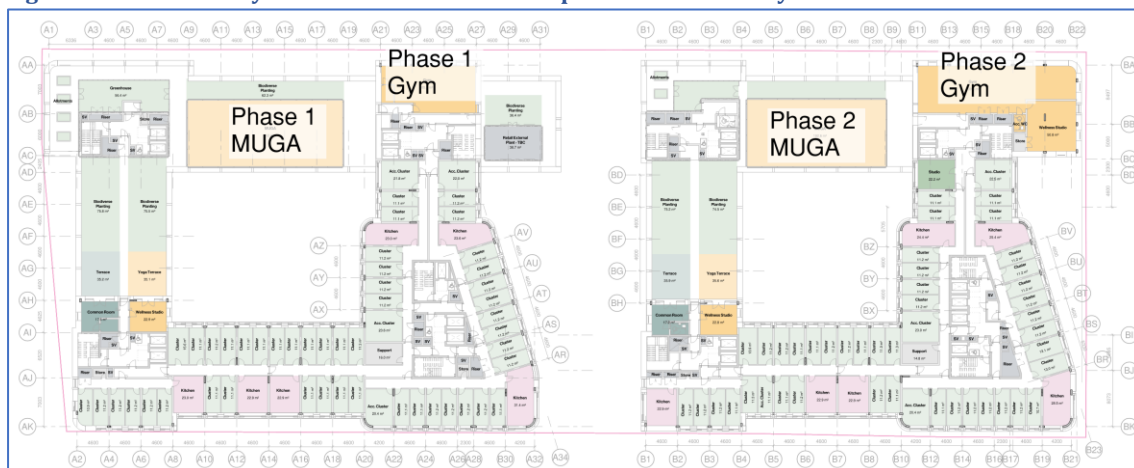
2. Site Location, Proposals and Sensitive Receptors

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), the A5103 and the 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 proposals comprise two MUGAs at and two Gymsnasiums on Level 7 of each proposed block (referred to as Phase 1 and Phase 2). Whilst the Gyms will be located internally, the MUGAs will be largely open, with perforated cladding system erected around its boundaries.

Figure 1 below presents the proposed Level 7 GA layout, illustrating the location of the MUGAs and Gyms associated with Phases 1 and 2 of the proposed development.

Figure 1: Level 7 GA Layout and Location of the Proposed MUGAs and Gyms

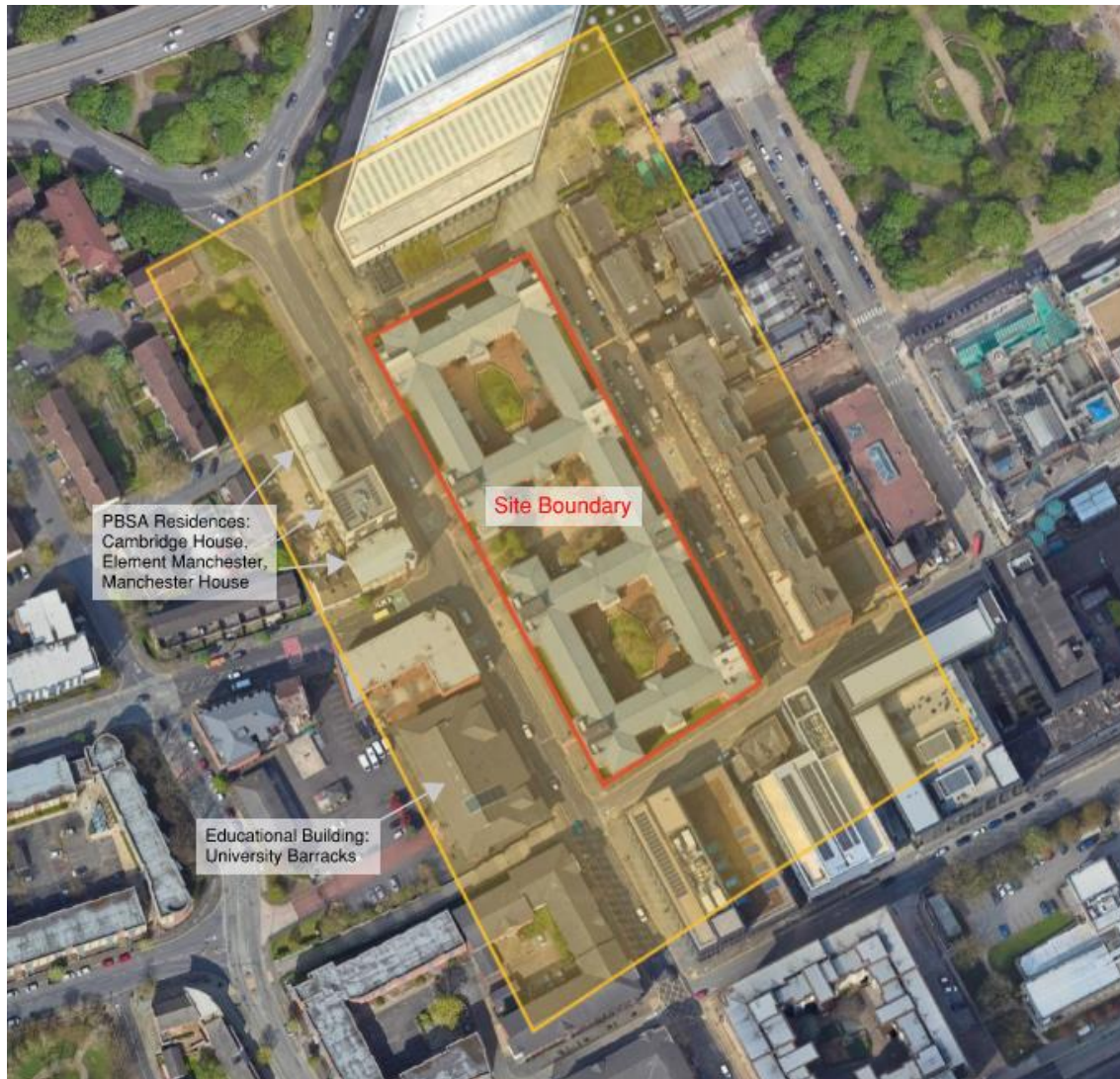


Potential off-site sensitive receptors include PBSA residences along Cambridge Street (A5067), as well as nearby Manchester Metropolitan University educational buildings. These receptors, along with the worst-affected on-site receptors (Phase 1 – Level 7

courtyard Acc Cluster; Phase 2 – Level 7 courtyard Studio) have been considered with reference to MUGA noise assessment.

Figure 2 below presents the site boundary and the worst-affected off-site PBSA and educational receptors to the proposed MUGAs.

Figure 2: Site Boundary and Nearest Receptors to the Proposed MUGAs



With reference to potential impacts associated with the proposed gyms, this Technical Note provides limits and guidance with respect to on-site receptors only (i.e. student/residential amenities directly adjoining the gyms). Off-site noise break-out via the gyms' façade is not deemed to be significant, considering the sealed nature of the proposed external façade, distance to the nearest off-site receptor, and the existing moderate to high levels road traffic noise.

3. MUGAs – Noise Assessment

3.1. Criteria

While noise from outdoor areas such as the MUGAs is typically not regulated under planning processes, this assessment references guidance in the Artificial Grass Pitch (AGP) Acoustics – Planning Implications (Sports England, 2015) design guidance note.

The AGP guidance references the 1999 WHO guidelines which recommended that to prevent serious annoyance during daytime hours (07:00 – 23:00), sound pressure levels on balconies, terraces, and outdoor living areas should not exceed 55 dB L_{Aeq} for steady, continuous noise sources. To avoid moderate annoyance, outdoor noise levels should not exceed 50 dB L_{Aeq} . While these criteria apply mainly to steady noise sources such as road traffic, they can serve as a useful reference in the absence of specific standards for outdoor sports facilities like the 3G pitch.

The AGP guidelines also recognise that in circumstances where existing noise levels are high, an alternative assessment methodology may be appropriate. The AGP guidelines refer to the IOA/IEMA Working Party Consultation Draft 2002, which categorises the significance based on a change in noise level, stating that a 3 dBA increase is the minimum perceptible change in noise under normal conditions. As such, the aim of this assessment is to ensure that the existing ambient noise is not increased at existing noise-sensitive receptors by 3 dBA as a result of the operations of the MUGAs.

Whilst every effort should be made to achieve this criteria at any on-site receptors as far as practicable, it should be acknowledged that it may not be feasible in the worst-cases, given the distance and lack of screening options (windows overlooking the MUGA) and anticipated quiet ambient noise conditions as the worst-affected units are facing the inner courtyard. More importantly, any on-site receptors will be new and occupiers would be taking up residency in the knowledge of the character of the area and its existing sources of noise and will not have a pre-existing expectation upon the noise climate.

It will be ensured that total ambient noise levels (existing road traffic combined with predicted MUGA noise) do not exceed suitable internal ambient noise levels within the units, as defined in BS 8233:2014. For daytime periods, these levels should be 35 dB $L_{Aeq,16\text{ hours}}$. This will take into account the sound insulation provided by the building envelope and the proposed background ventilation strategy.

For the purposes of this assessment, it is assumed that the MUGAs will only be operational during the daytime period (07:00–23:00), aligning with the WHO guidelines and BS 8233 criteria for noise management.

3.2. Prediction Methodology

The noise emissions from the proposed Multi-Use Games Areas (MUGAs) were predicted following the guidance outlined in the Artificial Grass Pitch (AGP) Acoustics guidance.



This methodology stipulates that noise levels from an AGP typically reach 58 dB $L_{Aeq,1hr}$ at a distance of 10 metres from the halfway line.

Predictions were performed using the Cadna/A noise modelling software, which integrates Calculation of Road Traffic Noise (CRTN) and ISO 9613-2 algorithms. This model considers factors such as screening, reflections, and attenuation effects arising from the existing and proposed buildings and other structures within the study area.

The MUGAs were modelled as area sources corresponding to their proposed locations (refer to Figure 1). Emission heights were set at 1.5 metres above local ground level, calibrated to align with the AGP guidance of 58 dB $L_{Aeq,1hr}$ at 10 metres from the centrelines. In line with typical use, it was assumed that the MUGAs would only operate during daytime hours (07:00–23:00).

For a worst-case scenario, simultaneous operation of both MUGAs was considered, and the proposed perforated cladding system designed for noise mitigation was deliberately excluded from the model to assess its unmitigated impact.

To estimate the potential increase in ambient noise levels due to MUGA operations, the existing ambient noise conditions were incorporated into the model. These were derived from measured noise levels obtained during environmental surveys conducted by Blackbird Acoustics in support of the wider Environmental Impact Assessment (EIA) (refer to report reference 2124.Rep.20241223.CHM.AAR.Rev1).

3.3. Predictions and Assessment of Noise Increase

The predicted noise levels associated with the use of the MUGAs are detailed below for both off-site and on-site receptors.

Table 1: MUGA Noise Predictions at Locations of Off-site Receptors

Receptor	Predicted MUGA Noise Level ($L_{Aeq,T}$ dB)	Predicted Existing Ambient Noise Level ($L_{Aeq,T}$ dB)	Calculated Increase of Existing Ambient Noise Level ($L_{Aeq,T}$ dB)
PBSA – Cambridge House	40	64	0
PBSA – Element Manchester	51	63	+0.3
PBSA – Opal Hall	39	67	0
University Barracks	40	67	0

As shown in Table 1, the predicted MUGA noise levels at off-site receptors result in a maximum increase of **+0.3 dB(A)** in the existing ambient noise climate. Such an increase is classified as **negligible** and is therefore considered acceptable.

Table 2: MUGA Noise Predictions at Locations of On-site Receptors

Receptor	Predicted MUGA Noise Level ($L_{Aeq,T}$ dB)	Predicted Existing Ambient Noise Level ($L_{Aeq,T}$ dB)	Calculated Increase of Existing Ambient Noise Level ($L_{Aeq,T}$ dB)
Phase 1 – Level 7 courtyard Acc Cluster north of the MUGA	59	41	+18.1
Phase 2 – Level 7 courtyard Studio north of the MUGA	59	41	+18.1

As shown in Table 2, at the worst-affected on-site receptors, MUGA activities are predicted to increase the ambient noise climate by +18.1 dB(A). This significant increase is attributed to the proximity of approximately 4 metres between the MUGA and these receptors, coupled with the low levels of background road traffic noise in these locations.

While this indicates that the MUGA will be the dominant noise source at these specific receptors, it is important to consider the following:

1. **Occupant Awareness:** Future occupants will move into the development with a clear understanding of the surrounding noise environment, including the

presence of MUGA activities, mitigating any unrealistic pre-existing expectations regarding the noise climate.

2. **Internal Noise Compliance:** The assessment in the following section is designed to ensure that cumulative ambient noise levels, including contributions from the MUGA, do not exceed **BS 8233:2014 internal ambient noise level guidelines** within the affected units. This includes consideration of the building's acoustic insulation performance and proposed ventilation strategy and is considered a more appropriate method to determine the impact at these receptors.

3.4. Noise break-in Predictions via Façade (On-site Receptors Only)

This section evaluates whether the recommended building envelope configuration, including the proposed background ventilation strategy, can adequately reduce noise from road traffic and MUGA activities to acceptable internal levels at the worst-affected on-site receptor, identified as the Level 7 courtyard studio in Phase 2 of the development. The assessment is based on the latest architectural drawings and proposals and considers the following parameters:

- Room dimensions of 5.3x4.2x2.5m (external façade 4.2x2.5m)
- 5.5m² of glazed area on external façade
- Mid-frequency reverberation time T_{mf} of 0.5s

Based on the Blackbird Acoustics noise assessment, the following glazing and ventilator configurations are recommended as a minimum for courtyard-facing areas to achieve acceptable internal noise levels:

Table 3: Proposed Courtyard Glazing Configuration Recommendation

Ventilator ref. and type	Minimum Recommended Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz)								R _w (dB)
	63	125	250	500	1k	2k	4k	8k	
'G4' – Any thermal double glazing with panes of different thickness	17	21	20	27	37	36	41	41	32

Table 4: Proposed Courtyard Ventilator Configuration Recommendation

Ventilator ref. and type	Minimum Recommended D _{n,e} (dB) at Octave Band Centre Frequency (Hz)								D _{n,e,w} (dB)
	63	125	250	500	1k	2k	4k	8k	
'V5' – Any nominally acoustically rated "through the frame" trickle ventilator	22	28	31	34	33	31	31	31	33

Additionally, any non-glazed areas are expected to achieve a minimum sound reduction performance of R_w 50 dB.

Predicted Internal Noise Levels

Considering the **predicted noise levels**, recommended façade configurations, and assumptions outlined above, calculations indicate that internal noise levels within the worst-affected studio unit are expected to be up to $L_{Aeq,1hr}$ **32.5 dB(A)** during daytime periods. This outcome is within with **BS 8233:2014 guidelines**, which recommend a maximum internal noise level of $L_{Aeq,16hr}$ **35 dB(A)** for daytime use. It should also be noted that the predictions are representative of the worst-case 1-hour noise levels and therefore the noise level across the entire daytime period is expected to be less; this is because the MUGA is unlikely to be used continuously for 16 hours.

Night-time Considerations

The MUGAs are not expected to operate during night-time periods. Therefore, this assessment is sufficient to demonstrate the suitability of the current building envelope and ventilation proposals from a noise perspective.

Vibration and Structure-borne Noise

In addition to airborne noise emissions, the MUGAs may generate vibration and structure-borne noise in residential areas directly below, depending on the final floor build-up. In such cases, it is recommended that the guidance and limits specified for gyms in Section 4 be applied to the separating floor design between the MUGAs and the residential units below to ensure compliance with acceptable vibration criteria.

4. Gyms (and MUGAs) – Noise and Vibration Assessment

4.1. Overview

Phase 1 and Phase 2 of the development will include gyms located on Level 7 (refer to Figure 1). The operation of these gyms is expected to generate entertainment noise, such as amplified music, as well as sound and vibrations from gym equipment. Without proper mitigation, these noise and vibration emissions could intrude upon adjacent sensitive spaces, particularly the clusters and studios situated directly above and below the gyms.

Effective mitigation measures are essential to ensure compliance with noise and vibration standards. The level of airborne sound insulation required will depend on the anticipated noise levels from gym operations during both daytime and night-time periods, as well as the internal noise criteria applicable to adjacent sensitive uses. Additionally, specifying appropriate floor finishes is critical for controlling impact noise transmission to residential areas below the gym spaces.

4.2. Guidance on Noise Criteria

The ProPG: Gym Acoustics Guidance, 2023 (GAG) provides internal sound target criteria for sensitive spaces adjacent to gymnasiums. This guidance introduces G-Curves, a framework for referencing sound spectra data in 1/3-octave bands, which offers enhanced resolution compared to traditional Noise Rating (NR) curves. The G-Curves framework is particularly effective for analysing lower-frequency noise, which is often the most disruptive in gym environments.

Table 5 below sets out the guidance on internal sound target criteria in residential areas, adjacent to a gymnasium.

Table 5: Guidance Internal Sound Target Criteria for Gym Activity – Residential Areas

Receptor Type	Airborne Sound (e.g. music) $L_{eq,T}$ (31.5Hz to 8kHz) (dB)	Heavy Impact Sound $L_{max,F}$ (31.5Hz to 8kHz)
Residential Areas	G15 – G25 (day) G10 – G20 (night)	G20 – G25 (day) G15 – G20 (night)

To achieve the internal sound targets outlined in Table 5, separating structures—primarily the separating floor—must be designed with sufficient sound insulation to prevent excessive airborne and impact noise transfer from the gyms to adjacent residential areas.

4.3. Guidance on Vibration Criteria

Gym activities, such as weight drops and use of cardio equipment, can cause vibrations that propagate through the building structure and result in re-radiated noise in adjacent sensitive spaces. To mitigate this, the GAG sets out specific vibration target criteria.

Table 6: Guidance Internal Vibration Target Criteria for Gym Activity – Residential Areas

Receptor Type	Tactile Vibration (point of entry to the body) Acceleration (mm/s^2)	
Residential Areas	rms $7 \text{ mm/s}^2 W_b$	Peak $21 \text{ mm/s}^2 W_b$

The separating floor and other structures between the gyms and residential spaces must be designed to meet these vibration criteria. Areas designated for weights will require higher-performance flooring compared to cardio areas.

4.4. Design Recommendations

At this stage, there is not sufficient information to provide a full detailed design of the gym and the relevant separating structures. The following recommendations should be adhered to so that it can be ensured that significant adverse impacts on future residents are avoided, and adverse impacts are mitigated wherever possible:

1. Flooring Specifications:

Before finalising the flooring design, preliminary acoustic testing should be conducted to evaluate the proposed floor finishes under simulated conditions.

Testing should include measurements of noise and vibration in the most affected residential rooms below the gym. These tests should inform the design of the separating floor which should be selected to ensure that the criteria in Tables 5 and 6 are achieved. Where certain gym activities cannot be mitigated, for example weight drops above a certain mass, then these activities should not be carried out in the finished gym.

2. Treadmills:

Treadmills should be installed on individual isolation pads, selected to achieve the Table 5 and 6 criteria in addition to the specified floor finish to minimise vibration transmission.

3. Weight Machines:

Weight machines should be isolated at the source and not directly bolted to the building structure to prevent structure-borne noise transmission.

4. High-Impact Activities:

Activities such as medicine ball slams should be avoided to minimise excessive noise and vibration impacts.

By adhering to these recommendations and design criteria, the gyms can operate effectively without adversely impacting adjacent residential areas.

5. Conclusion

This technical note has provided a comprehensive noise and vibration assessment for the proposed Multi-Use Games Areas (MUGAs) and Gyms, forming part of the re-development of Cambridge Halls at 41 Cavendish Street, Manchester, M15 6TT.

The assessment concludes that:

1. MUGA Impacts:

- The proposed MUGAs are not anticipated to cause any significant increase in the existing ambient noise climate at off-site noise-sensitive receptors.
- For on-site receptors, internal ambient noise levels within the worst-affected plots are expected to remain within acceptable limits, due to the sound reduction provided by the building envelope.

2. Gym Noise and Vibration:

- Noise and vibration limits for the proposed gyms have been established based on industry best practices and relevant guidance.
- The implementation of robust design measures, including appropriate sound insulation and vibration control, will ensure compliance with the specified limits and safeguard sensitive spaces within the development.



By adhering to the recommendations and limits set out in this assessment, the proposed design can effectively manage noise and vibration impacts, maintaining a high standard of acoustic comfort for both on-site occupants and the surrounding community.