Technical Report
Acoustic Barrier Design Review and Technical Reframing

AL MARASEM - Fifth Square Mall Project

Prepared for	Dr.elshaimaa rageay
Source basis	Technical Report on Acoustic Barrier Calculations
Project date in source file	06/07/2025
Report date	21/04/2026

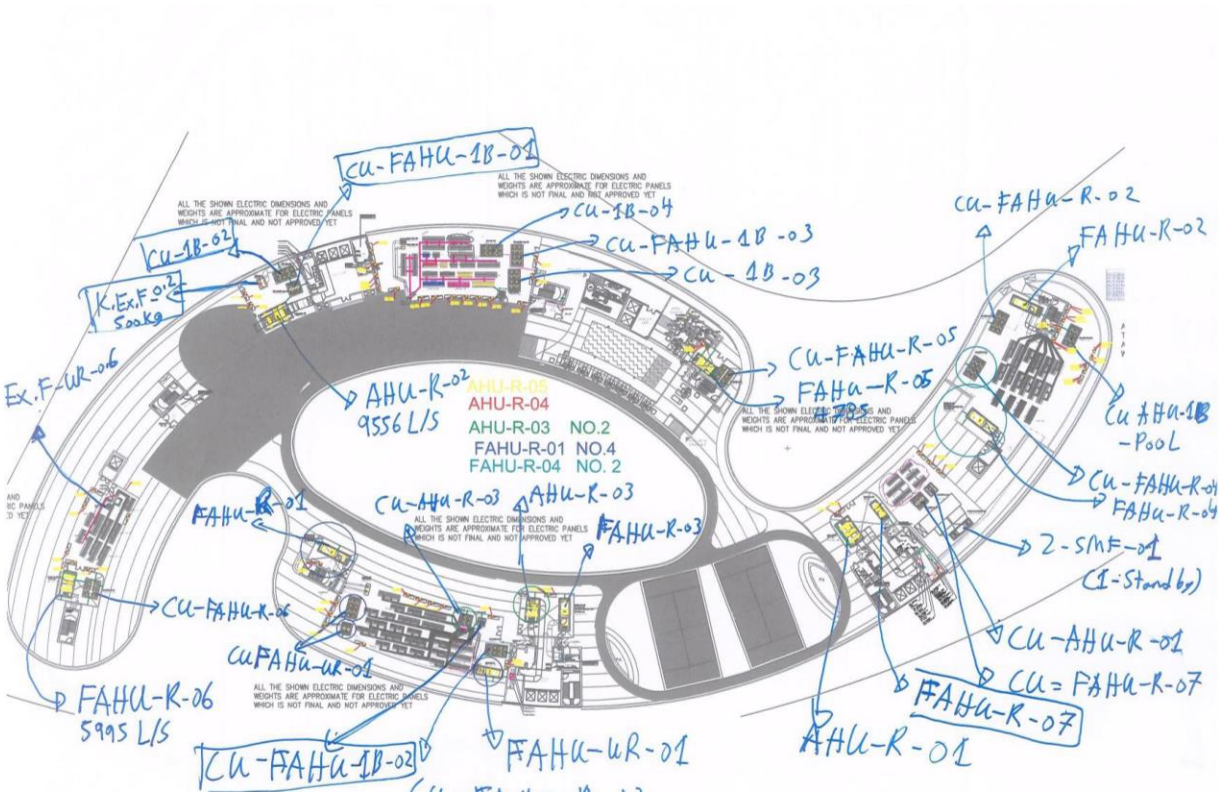

Figure 1. Annotated rooftop plan reproduced from the source report, showing the distributed rooftop HVAC locations used as the spatial basis of the barrier discussion.

Executive Summary

The uploaded source document addresses acoustic barriers for rooftop AHU and FAHU equipment at AL MARASEM - Fifth Square Mall and targets an overall noise reduction of 20 dB per evaluated unit using external barriers. The document is concise and practice-oriented, but it benefits from restructuring, clearer engineering traceability, and integration of accepted references for HVAC noise control and outdoor barrier performance.

Five units with available datasheets are explicitly tabulated in the source report: AHU-R-03, AHU-R-04, AHU-R-05, FAHU-R-01, and FAHU-R-04. Together, these units represent 1532.9 kW of cooling capacity and 45.686 m^3/s of airflow. The wider rooftop inventory illustrated in the source plan includes 19 listed positions across seven areas, meaning the available tabulated input data cover only part of the full rooftop population.

A key technical observation is that the simplified height relation written in the source report behaves as a screening formula rather than a final design method. When applied directly with r = 3 m and IL = 20 dB, it predicts a barrier height of approximately 29.8 m, whereas the source report concludes that a practical height of around 3 m is generally required. This mismatch indicates that the final project recommendation must rely on combined engineering judgement, geometric shielding, path control, and supplementary treatments rather than on the simplified formula alone.

Accordingly, this reframed technical report keeps the original project intent but adds: (1) a more explicit data audit, (2) reconstructed tables, (3) derived charts, (4) a clearer distinction between source assumptions and design recommendations, and (5) an integrated reference framework aligned with ANSI/ASA room-noise criteria, outdoor barrier insertion-loss methodology, HVAC noise-and-vibration practice, and outdoor propagation methods.

Important technical note. ANSI/ASA S12.2-2019 is appropriate for room-noise evaluation, but rooftop barrier sizing should also be checked using accepted outdoor insertion-loss and propagation methods rather than a single screening equation alone.

1. Background and Source Basis

The source PDF is an internal ENOSH report titled Technical Report on Acoustic Barrier Calculations for the AL MARASEM - Fifth Square Mall project. Its stated purpose is to estimate the barrier dimensions required to reduce noise emissions from AHUs and FAHUs using factory sound-pressure information at a distance of 3 m and a target attenuation of 20 dB.

The source file provides three layers of information: first, a short methodological statement with two governing equations; second, a practical construction note for sound-brick barrier walls, louvers, access, and vibration isolation; and third, a limited equipment dataset combined with an annotated rooftop plan. The available source pages therefore support a preliminary design review, but not a final issued-for-construction acoustic package.

Unit	Model	Cooling Capacity (kW)	Air Flow (LPS)	ESP (Pa)	Qty
AHU-R-03	GHX 425A	139.2 kW	5,111	600	1
AHU-R-04	GHX 960A	288.1 kW	11,474	650	1
AHU-R-05	GHX 520A	166.7 kW	6,051	500	1
FAHU-R-01	GHX 705A	356.1 kW	8,955	400	1
FAHU-R-04	GHX 1230A	582.8 kW	14,095	400	1

Figure 2. Snapshot of the unit schedule reproduced from the source report.

2. Analytical Basis and Engineering Method

The source document uses a free-field screening relation to estimate sound pressure level from sound power and a simplified relation to back-calculate barrier height from target insertion loss. These expressions are restated below exactly as engineering screening tools, not as stand-alone final design formulas.

$$Lp = Lw - 20 \log10(r) - 8$$

$$IL \sim= 10 \log10(1 + H^2/r^2), \text{ therefore } H = r \sqrt{(10^{(IL/10)} - 1)}$$

Within the source report, barrier width is assumed to scale with airflow at 1.2 m^2 per 1 m^3/s. This assumption has value as a rough proportionality index for planning envelope size and free-area strategy, but it is not by itself a substitute for final airflow, pressure-drop, discharge, maintenance-clearance, and recirculation checks.

For technical reporting purposes, the present reframing separates the workflow into four stages: (1) source-data audit, (2) engineering reconstruction of the tabulated units, (3) sensitivity review of the stated barrier-height screening equation, and (4) consolidation of practical barrier recommendations consistent with HVAC noise-control guidance and outdoor-barrier methodology.

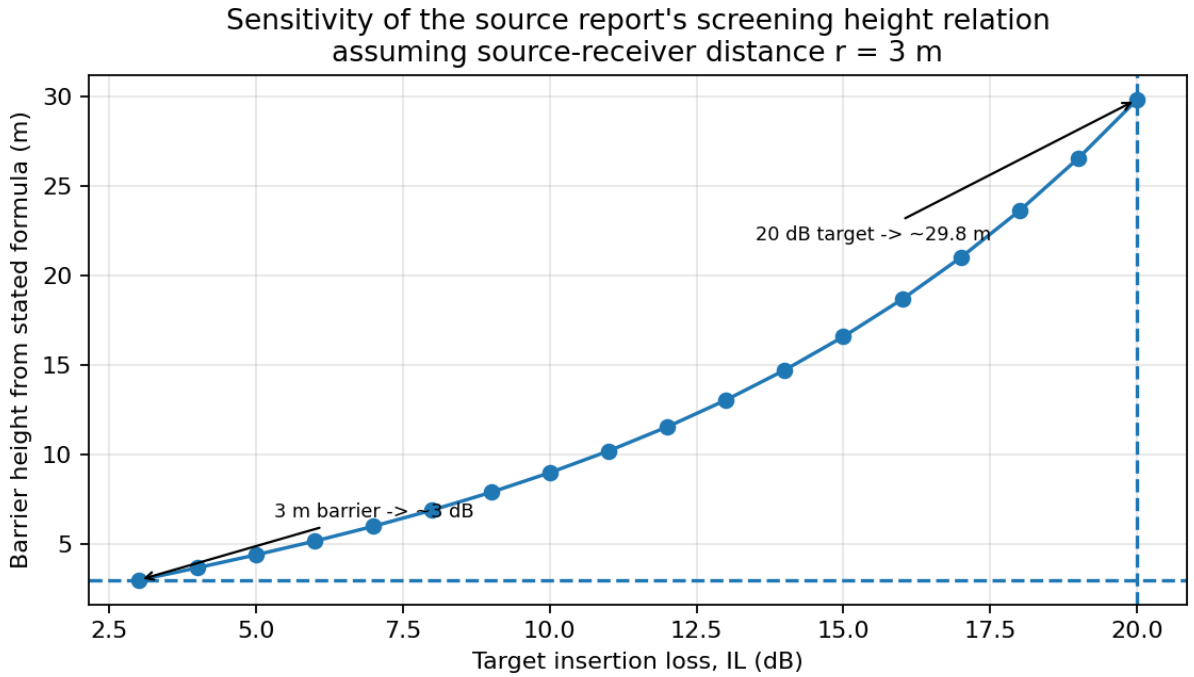

Figure 3. Sensitivity of the source report's screening height relation. Direct use of the stated equation with a 20 dB target and r = 3 m implies a height near 29.8 m; therefore the source report's practical 3 m recommendation must be interpreted as a preliminary design judgement supported by additional control measures.

3. Source Inventory and Available Data

Table 1 reconstructs the five units with explicit datasheet values available in the source report. Airflow has been converted from L/s to m^3/s, and an indicative barrier-area index has been added using the source assumption of 1.2 m^2 per 1 m^3/s.

Unit	Model	Cooling (kW)	Airflow (L/s)	Airflow (m^3/s)	ESP (Pa)	Qty	Barrier area index (m^2)
AHU-R-03	GHX 425A	139.2	5,111	5.111	600	1	6.13
AHU-R-04	GHX 960A	288.1	11,474	11.474	650	1	13.77
AHU-R-05	GHX 520A	166.7	6,051	6.051	500	1	7.26
FAHU-R-01	GHX 705A	356.1	8,955	8.955	400	1	10.75
FAHU-R-04	GHX 1230A	582.8	14,095	14.095	400	1	16.91

Across the five tabulated units, the combined cooling capacity is 1532.9 kW and the combined airflow is 45.686 m^3/s. Under the source proportionality assumption, this corresponds to a cumulative barrier-area index of 54.82 m^2.

Table 2 summarizes the rooftop inventory structure reconstructed from the annotated layout tables in the source PDF.

Area	Listed rooftop positions
Area 1	5
Area 2	1
Area 3	3
Area 4	3
Area 5	2
Area 6	2
Area 7	3

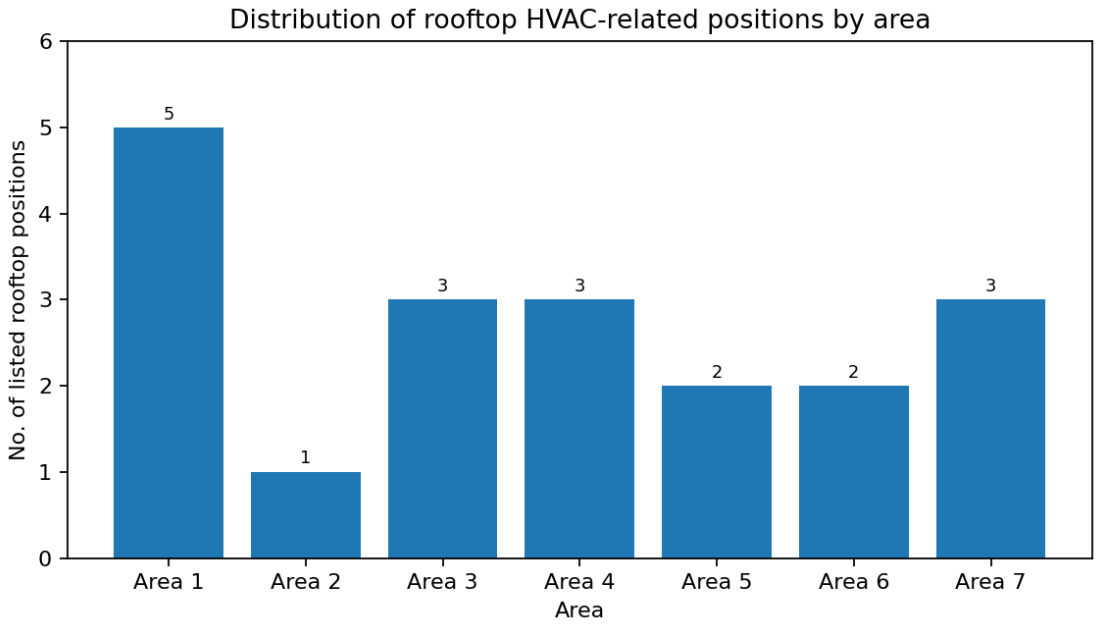

Figure 4. Distribution of listed rooftop positions across Areas 1 to 7. Area 1 contains the largest concentration in the available rooftop inventory.

4. Results and Engineering Interpretation

The reconstructed dataset shows a wide spread in unit scale. FAHU-R-04 is the dominant studied unit in both cooling capacity and airflow, while AHU-R-03 is the smallest among the explicitly tabulated units. This ranking matters acoustically because larger airflow demand usually pushes larger openings, stronger fan duty, stricter louver design, and greater risk of performance degradation if the barrier geometry is not coordinated with ventilation strategy.

The source document reports that practical acoustic barriers of about 3 m height are generally required. Taken as a project-level screening recommendation, this is plausible only when the barrier works as one element within a broader control package that also includes sufficient wall length beyond the source width, absorptive inner treatment where useful, non-short-circuiting airflow paths, acoustic louvers, vibration isolation, and structural separation of the barrier from the machine support frame.

The report's material recommendations are technically consistent with good practice: dense masonry or concrete construction, a wall thickness of roughly 200 to 300 mm, an absorptive inner face if required, Z-baffle acoustic louvers rather than open grilles, and a gasketed access panel. However, barrier performance will remain strongly dependent on diffraction around the top and ends; therefore barrier length extension and the relative positions of source, barrier edge, and receiver are as important as wall mass.

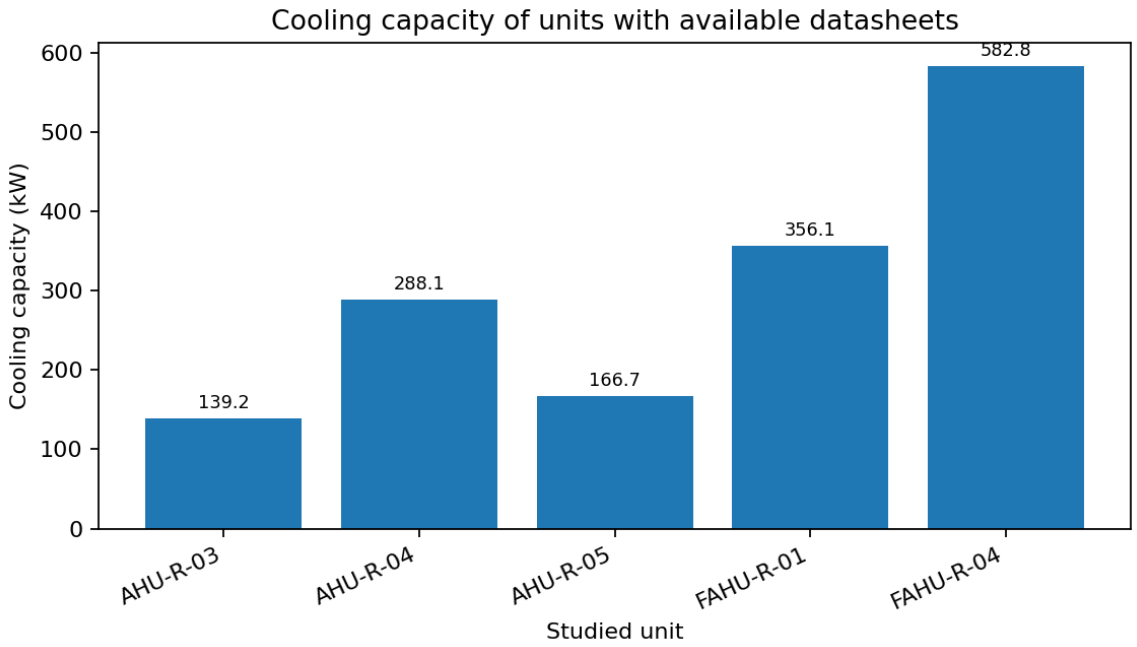

Figure 5. Cooling capacity of the five units with explicit source datasheets.

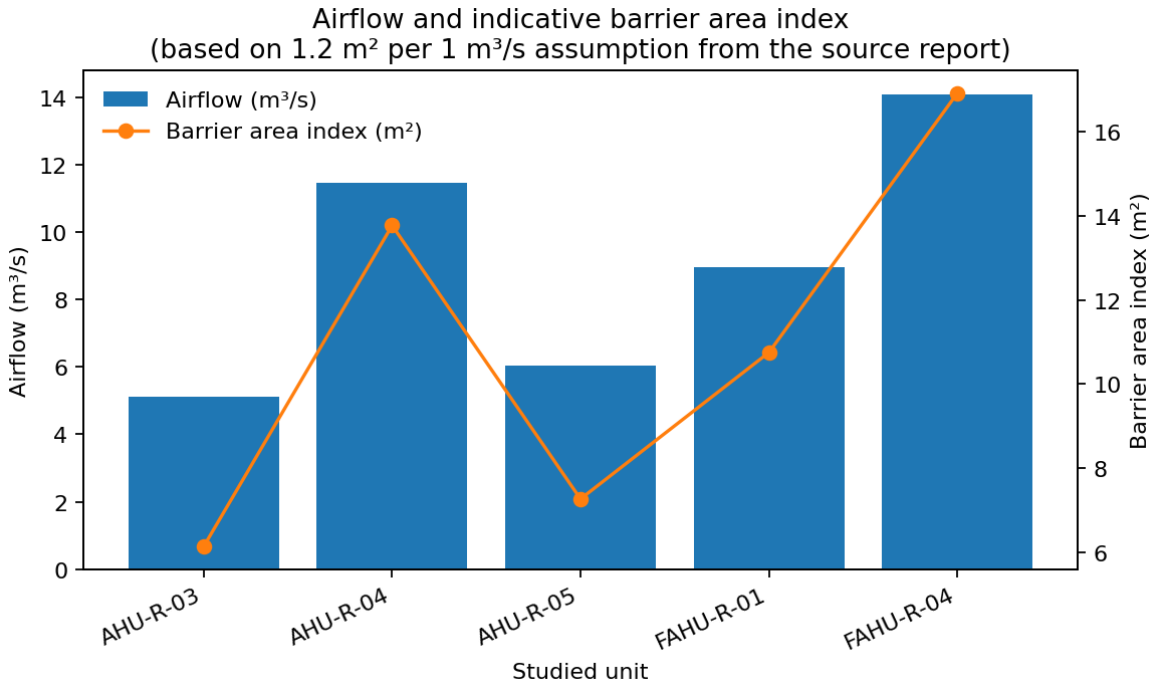

Figure 6. Airflow and indicative barrier-area index derived from the source assumption of 1.2 m^2 per 1 m^3/s.

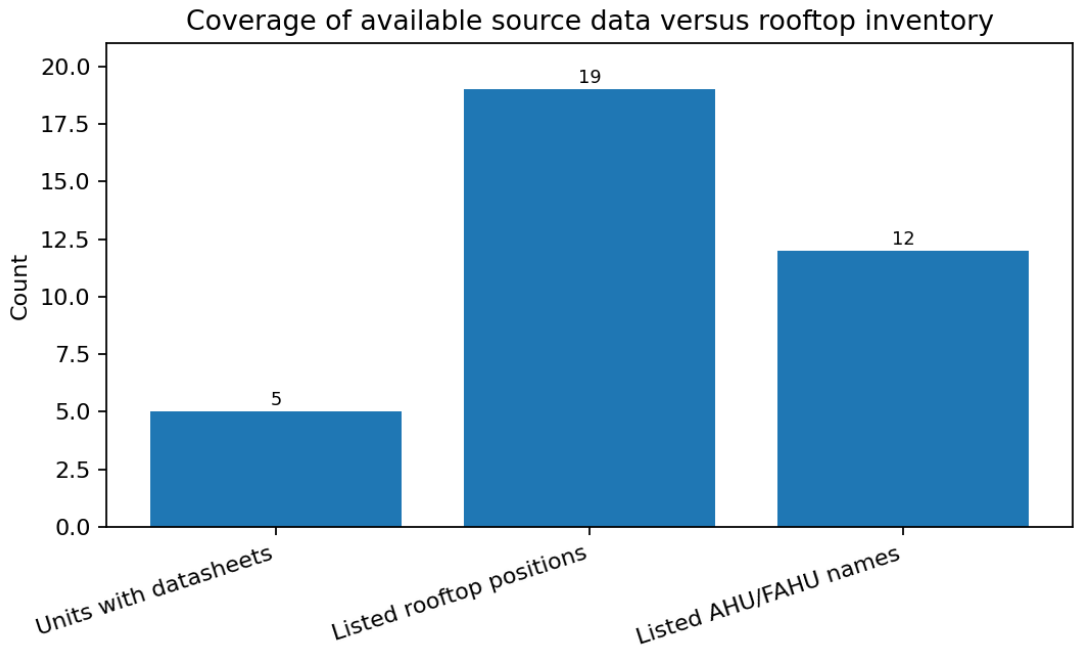

Figure 7. The explicit unit datasheets cover only a subset of the total rooftop population shown in the source plan.

5. Recommended Technical Design Guidance

Based on the uploaded source report and the broader reference framework, the following technical guidance is recommended for any next-stage design package:

Design item	Technical recommendation
Barrier mass and continuity	Use dense concrete or sound-brick construction with airtight joints; avoid lightweight discontinuous barriers where low-frequency fan noise is important.
Barrier geometry	Extend the barrier beyond the unit plan width and control top-edge diffraction with sufficient height, end returns, or cap geometry; do not rely on wall height alone.
Ventilation path	Coordinate louver free area, discharge path, and static-pressure impact so that noise control does not create thermal or airflow penalties.
Absorptive treatment	Where reverberant build-up inside the barrier enclosure is a concern, line the inner face using durable perforated facing plus mineral wool or an equivalent weather-protected absorptive system.
Vibration control	Mount the HVAC units on anti-vibration isolators and keep the barrier structure independent from the equipment support curb or frame to avoid structure-borne transmission.
Access and maintenance	Provide acoustically sealed access doors or removable panels so the barrier remains serviceable without creating permanent leakage paths.
Verification	Validate the final design using a dedicated outdoor propagation and barrier insertion-loss method and confirm the post-installation outcome by field measurement.

6. Limitations of the Current Dataset

The uploaded source report is explicitly partial. It does not contain full datasheets for all AHU, FAHU, and CU systems shown on the rooftop plan. The resulting calculations therefore represent only a preliminary subset review rather than a complete project barrier schedule.

The source method uses a simplified barrier-height relation that should not be treated as a final diffraction model. As demonstrated in Figure 3, direct use of that relation yields a result inconsistent with the practical 3 m conclusion stated in the source report.

No octave-band sound-power spectra for all rooftop units, receptor grid definition, façade receiver coordinates, louver aerodynamic data, or post-treatment verification measurements are included in the uploaded file. These omissions are significant for final design and must be closed before issue-for-construction documentation.

7. Conclusion

The uploaded acoustic-barrier PDF provides a useful preliminary project basis for rooftop HVAC noise control at AL MARASEM - Fifth Square Mall. When reorganized into a fuller technical report, the central engineering picture becomes clear: the source report is directionally sound on barrier mass, louver treatment, vibration isolation, and the need for approximately 3 m practical shielding, but the analytical trace from the stated screening equation to the final barrier height is incomplete and should be treated cautiously.

Accordingly, the most defensible interpretation is that a 3 m barrier is a project screening recommendation that must be confirmed by detailed geometric modeling and measurement-based validation. Final barrier design should therefore be developed as a combined source-path strategy rather than as a wall-height exercise alone.

8. Future Work

- Obtain full datasheets and octave-band acoustic data for every rooftop AHU, FAHU, and CU shown on the annotated roof plan.
- Build a receiver-based outdoor prediction model using accepted propagation and barrier insertion-loss methods, then optimize barrier height, length, and louver configuration iteratively.
- Prepare a unit-by-unit barrier schedule with dimensions, sections, material build-ups, louver free area, maintenance doors, and vibration-isolation details.
- Complete post-installation commissioning measurements to verify insertion loss and residual noise levels at the critical receivers.

Acknowledgment

This reframed technical report is based on the uploaded project document provided for review and redevelopment.

Conflict of Interest

No commercial conflict of interest is declared for the preparation of this reformatted technical report. The analysis is limited to the uploaded source material and the public technical references listed below.

References

Acoustical Society of America. (2019). ANSI/ASA S12.2-2019: Criteria for Evaluating Room Noise.

Acoustical Society of America. (2013). ANSI/ASA S12.8-1998 (R2013): Methods for Determining the Insertion Loss of Outdoor Noise Barriers.

AHRI. (2008). AHRI Standard 885: Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

ASHRAE. (2023). ASHRAE Handbook - HVAC Applications, Chapter 49: Noise and Vibration Control.

CIBSE. (2016). Guide B4: Noise and Vibration Control for Building Services Systems.

Enosh Science Center. (2025). Technical Report on Acoustic Barrier Calculations - the AL MARASEM - Fifth Square Mall project. Uploaded source PDF.

Federal Highway Administration. (2017). Noise Barrier Design Handbook.

ISO. (2025). ISO 9613-2: Attenuation of Sound During Propagation Outdoors - Part 2: Engineering Method for the Prediction of Sound Pressure Levels Outdoors.