CST Environmental & Acoustic Consultants

Proposals for Installation of fixed a/c plant
Planning Noise Assessment

1/1A Montague Street
London
WC1B 5BU

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September 2017

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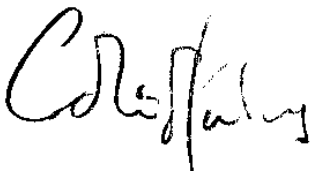


Report Prepared by:……..

Checked by:……LDS

Date:……18th September 2017

1.0 Executive Summary

1.1 This report has been commissioned by Frankham Consultancy Group Ltd. in support of a planning application for the installation of external condensing (VRV) plant to the rear of the subject building as part of a renovation and upgrade scheme for existing offices for the British Museum. It updates a previous (June 2017 assessment) which was prepared with reference to the London Borough of Camden (LBC) Planning Guidance that was extant at that time. Following submission of the planning application LBC adopted a new local plan which contains revised local noise standards. Officers have requested that the noise assessment be updated to reflect these latest standards. For the avoidance of doubt no new noise measurements have been undertaken as it is considered that those used to inform the June 2017 are still within calibration.

1.2 The site comprises the end building of a substantial terrace of similar properties constructed in the 17th and 18th Century. Although originally built for residential use the subject building along with all of the rest of the terrace is now part of the British Museum office and research department.

1.3 As part of a comprehensive refurbishment of the premises it is proposed to locate HVAC plant externally to the rear of the properties at ground floor level. The proposed locations for the external plant can be see at appendix 3 (design scheme extract).

1.4 A number of technical terms are referred to both in this summary and in the main report. A glossary of acoustic terms is to be found at appendix 4.

1.5 The results of the baseline survey show that the local sound environment is materially influenced by HVAC plant (chillers) located along the southern site boundary. We understand these serve the Hirayama Studio; the plant is accessed via a CAT ladder in the garden of 1 & 1A.

1.6 The nearest potentially sensitive residential receptor was identified as the rear facade of The Grange White Hall Hotel (2 -5 Montague Street) located 11.5 metres from the proposed installation.

1.7 The type and numbers of proposed external plant are listed below. Noise data for the plant have been taken from manufacturers' data sheets, extracts of which are to be found at appendix 1.

1.8 Schedule of Proposed External Plant (Total 4 items)

- Building 1 System 1 - 1No. Outdoor Unit – PURY-EP450YLM-A1.
- Building 1 System 2 - 1No. Outdoor Unit– PURY-EP350YLM-A1.
- Building 1A System 1 - 1 No. Outdoor Unit– PURY-EP250YLM-A1.
- Building 1A System 2 -1No. Outdoor Unit– PURY-EP250YLM-A1.

I.9 By reference to LBC's updated local noise standards it is predicted that the proposals will fall at the boundary of green / amber with the mitigation as proposed. No adverse implications for the local sound environment are indicated.

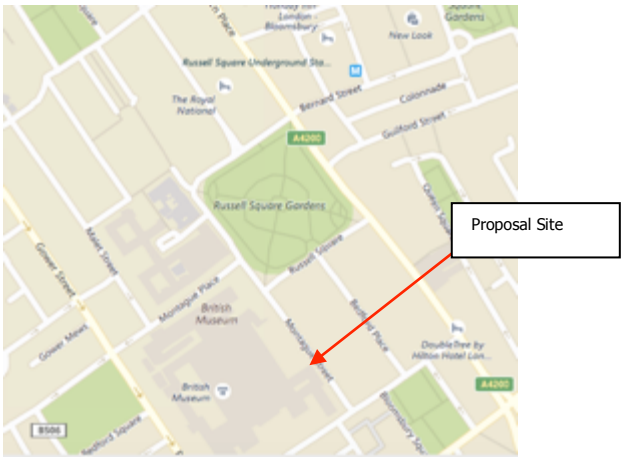
2.0 Objectives of Report

2.1 The objectives of this report are:

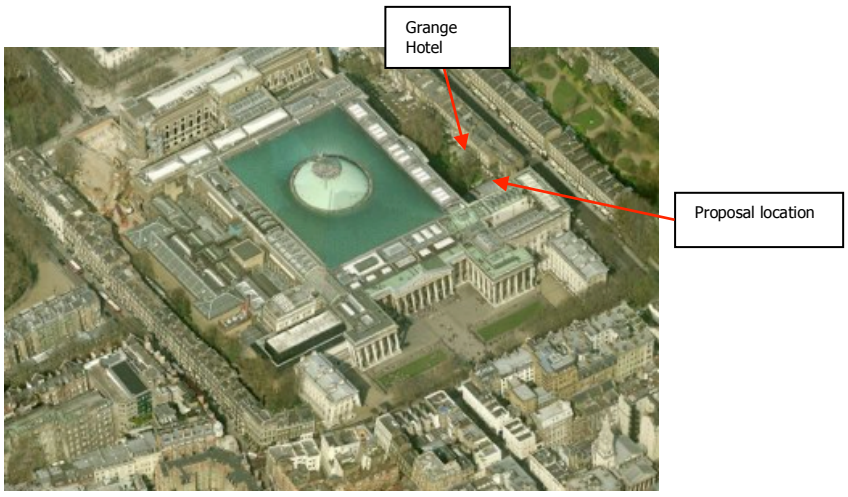
- To establish representative baseline sound levels for the proposal site.
- To assess the extent to which the proposed plant can comply with LB Camden local noise standards (with mitigation if required).

3.0 Description of Site

3 .1 The site is to be found at approximate grid reference 530144(E): 181763(N). It is further identified by an extract of the location plan below:



3.2 The aerial photograph below shows the proposal location in relation to its surroundings. The nearest residential accommodation was identified as The Grange White Hall Hotel which is some 11.5 meters from the proposal location.



4.0 The Survey

4.1 A single survey position was established at ground floor level in the rear garden of the subject building. The survey equipment and survey location can be seen in the photograph below:

View of Survey Position (Looking north)

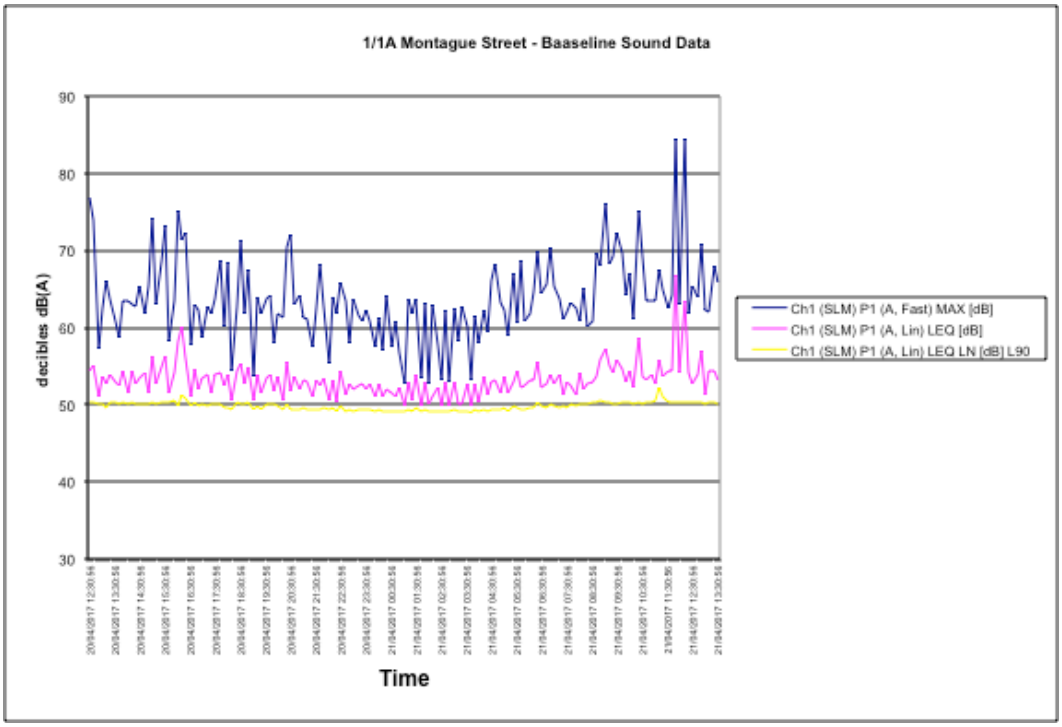
4.2 A Svantek 959 precision grade sound level meter was used to objectively measure the local sound environment from around 11:30 hrs on 20th April 2017 to 12:30hrs on 22nd April 2017. The meter was mounted on a tripod at a height approximately 1.5m above ground level.

4.3 The memory features of the meter were used to automatically capture and store sound energy data every 10 minutes. The meter (Serial number 11229) was calibrated on site prior to the commencement of the survey to 104dB using a Castle Associates acoustic calibrator (serial number 0500301). A calibration check was also performed at the end of the survey period. No drift in calibration was observed. The weather was fine and dry throughout the survey with a light south westerly breeze (less than 5m/s).

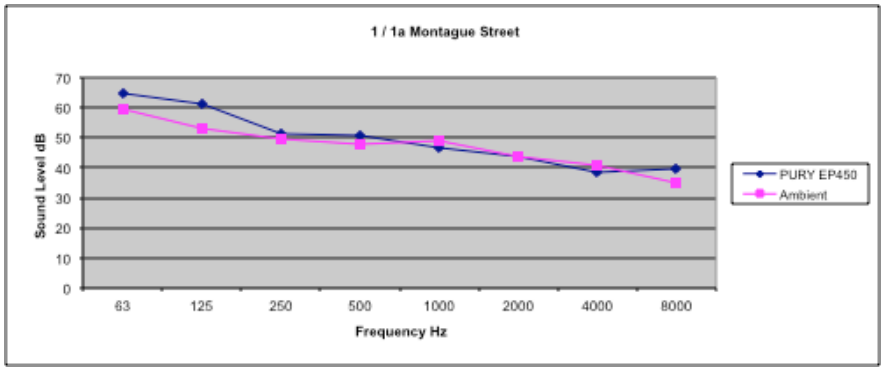
View from Garden No.1 to proposed plant location

5.0 Survey Results

5.1 The following graph, compiled from the raw survey data shows the time / sound level history recorded at the survey point.



5.2 The above graph confirms a subjective assessment that the sound environment in the rear garden of No.1 / 1A Montague Street is materially impacted by the existing Hirayama Studio plant which operates 24/7. The following graph provides a frequency analysis comparison between the measured ambient sound and the proposed plant. It can be seen from the following graphs that the proposed plant will exhibit a very similar tonal signature to that already existing. This is relevant to the BS 4142: 2014 assessment which advises that where new tonal components are to be introduced by a new noise source it may be appropriate to apply up to a 15dB penalty to account for potentially annoying tonal components. In this case it is considered that no tonal penalty is justified.



5.3 Discussion of the Survey Results

5.4 The local sound environment is materially impacted by day and night from the adjoining chiller plant. Reference to the above graph shows there is very little diurnal variation in either the ambient (L_{Aeq}) or background (L_{A90}) noise levels.

6.0 Assessment Framework & Policy Considerations

6.1 Updated Local Plan Requirements (July 2017)

6.2 The 2017 Camden Local Plan has updated the authority's planning policies in response to national guidance as set by Government in the National Planning Policy Framework (NPPF). At the heart of the NPPF there is now a presumption in favour of sustainable development, the planning system now being required to contribute to the achievement of "sustainable development". However current national planning guidance also advises that to prevent unacceptable risks from pollution, new development must be appropriate for its location and the effects of pollution on amenity mitigated to an acceptable level.

6.3 Noise Policy Statement England (NPSE)

6.4 The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The vision of the NPSE is to "Promote good health and good quality of life through the effective management of noise within the context of government policy on sustainable development".

6.5 The NPSE aims to "through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development".

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

6.6 The NPSE embraces three key concepts:

(i) No Observed Effect Level (NOEL) - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

(ii) Lowest Observed Adverse Effect Level (LOAEL) - This is the level above which adverse effects on health and quality of life can be detected.

(iii) Significant Observed Adverse Effect Level (SOAEL) - This is the level above which significant adverse effects on health and quality of life occur.

6.7 The table below sets out LB Camden's new requirements for noise fixed plant:

Policy A4 Noise and vibration

The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:

a. development likely to generate unacceptable noise and vibration impacts; or
b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.

Table "C" below (taken from the new local plan) summarises the LBC noise thresholds:

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

6.8 Commercial Noise Sources. Appendix 3 of new local plan advises:

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

7.0 Calculations - BS 4142:2014 Assessment

7.1 BS 4142:2014 describes a method for rating and assessing:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

7.2 If appropriate, the specific sound level of the source (LAeq,T) is corrected, by the application of one or more corrections for acoustic features such as tonal qualities and/or distinct impulses, to give a 'rating' level (LAr,Tr).The Standard effectively compares and rates the difference between the rating level of the specific sound and the typical background sound level (LA90,T) in the absence of the specific sound.

7.3 The BS advises that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) the source in question operates or is proposed to operate in the future.

7.4 Comparing the rating level with the background sound level, BS 4142 states:

- Typically, the greater this difference, the greater the magnitude of impact.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

7.5 As for our June 2017 evaluation, this assessment considers the combined effects of all the proposed units operating together full power. In practice during the evening and night periods overall sound emission levels will reduce by software control as shown on the manufacturer's data sheet extracts that form appendix 1.

7.6 The starting point for the calculation process is to identify the baseline background (L_{A90}) levels in the area. Table 1 below summarises the survey data in respect of the night and daytime periods now required by Appendix 3 of the LBC Local Plan.

Time	Measured L_{Aeq} 16/8 hr	Measured L_{A90} 16/8 hr
07:00 – 23:00 hrs	55	50
23:00 – 07:00 hrs	50	49

Table 1

7.7 Having established the baseline background noise environment it is possible to calculate the noise impact at specified distances from the proposed installation and compare these levels with the baseline L_{A90}. This process is set out in the following table (Table 3).

Receptor	Design Criteria & Calculations (Night)
1st Floor rear bedroom & G/F conservatory windows Rear of The Grange White Hall Hotel Note: * Attenuation for a point source given by formula Attn = 20*log d1/d2 ** Reference see: BS 5228:2009 Part 1 Ref: F.2.2.2.1	Background Sound Levels recorded: Night Time Background Levels = 49.0dB$L_{A90(8hr)}$ Proposed Plant – Building 1 1 No. Mitsubishi PURY EP350 - Sound Pressure Level @ 1m = 62.5dB(A) 1 No. Mitsubishi PURY EP450 – Sound Pressure Level @1m = 62.5 dB(A) Combined Source Sound Pressure Level (Lp) = 62.5+ 62.5 = 65.5dB(A) [full power] @1m Mitigation Proposal: Acoustic Enclosure. To install "Ambient Acoustics" enclosure to 2No. chillers Overall Sound Emission Level at 1 m therefore = 65.5dB(A) -12dB(A) = 53.5dB(A) Distance to Receptor = 11.5 metres. Distance Attenuation – 21dB(A)* With mitigation resultant emission level at nearest receptor = 53.5 -21= **32.5dB(A)** **BS 4142:2014 Assessment - Night Time** Measured Ambient = 55 dB(A) Residual Sound (Measured) = 55 dB(A) Acoustic feature correction = 0dB(A) Rating Level = 32.5 dBL_{AeqTr} Background Sound Level (LA90 – measured) = 49dB(A) Excess of Rating over Background = **minus 16.5dB** **Result** – The proposals comply with LBC noise thresholds

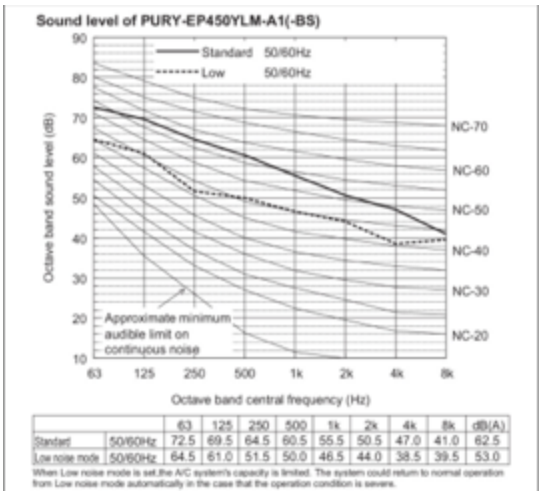
Receptor	Design Criteria & Calculations (Day)
1st Floor rear bedroom & G/F conservatory windows Rear of The Grange White Hall Hotel Note: * Attenuation for a point source given by formula Attn = 20*log d1/d2 ** Reference see: BS 5228:2009 Part 1 Ref: F.2.2.2.1	Background Sound Levels recorded: Day Time Background Levels = 50.0dB$L_{A90(8hr)}$ Proposed Plant – Building 1 1 No. Mitsubishi PURY EP350 - Sound Pressure Level @ 1m = 62.5dB(A) 1 No. Mitsubishi PURY EP450 – Sound Pressure Level @1m = 62.5 dB(A) Combined Source Sound Pressure Level (Lp) = 62.5+ 62.5 = 65.5dB(A) [full power] @1m Mitigation Proposal: Acoustic Enclosure. To install "Ambient Acoustics" enclosure to 2No. chillers Overall Sound Emission Level at 1 m therefore = 65.5dB(A) -12dB(A) = 53.5dB(A) Distance to Receptor = 11.5 metres. Distance Attenuation – 21dB(A)* With mitigation resultant emission (rating) level at nearest receptor = 53.5 -21= **32.5dB(A)** **BS 4142:2014 Assessment - Day Time** Measured Ambient = 55 dB(A) Residual Sound (Measured) = 55 dB(A) Acoustic feature correction = 0dB(A) Rating Level = 32.5 dBL_{AeqTr} Background Sound Level (LA90 measured) = 50dB(A) Excess of Rating over Background = **minus 17.5dB** **Result** – The proposals comply with LBC noise thresholds

8.0 Conclusions

8.1 A baseline assessment of the local sound environment has been carried out.

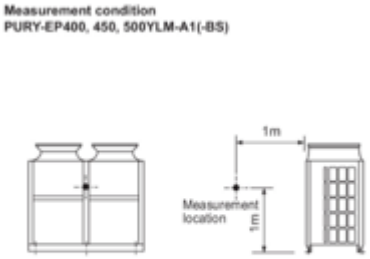
8.2 With attenuators fitted as proposed the combined effects of all the proposed plant are predicted to meet the LPA requirements contained in the LB Camden Local Plan (July 2017).

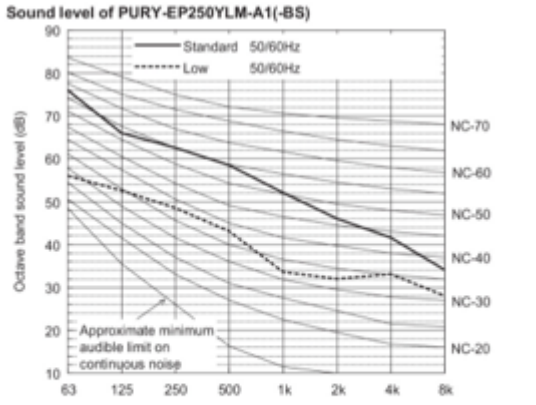
9.0 Appendix 1 - Manufacturer's Sound Data



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	72.5	69.5	64.5	60.5	55.5	50.5	47.0	41.0	62.5
Low noise mode	50/60Hz	64.5	61.0	51.5	50.0	46.5	44.0	38.5	39.5	53.0

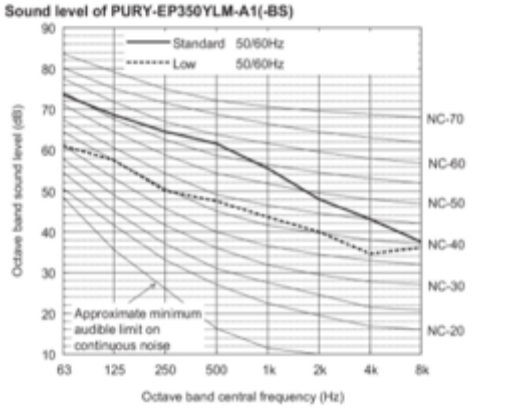
When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.





		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	76.0	66.0	62.5	58.5	52.0	46.0	41.5	34.0	60.0
Low noise mode	50/60Hz	56.0	52.5	48.5	43.0	33.5	32.0	33.0	28.0	45.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	73.5	68.5	64.5	61.5	55.5	48.0	43.0	37.5	62.5
Low noise mode	50/60Hz	61.0	57.5	50.0	47.5	43.5	40.0	34.5	36.0	50.0

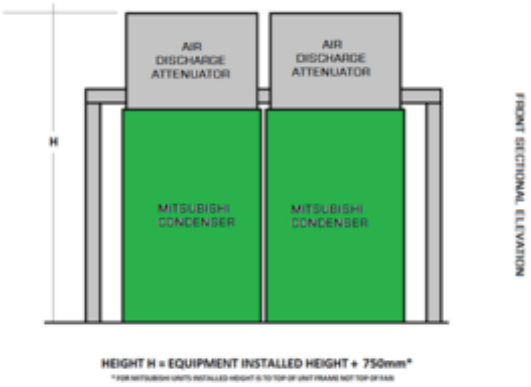
When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

10.0 Appendix 2 - Manufacturer's Information (Attenuators)

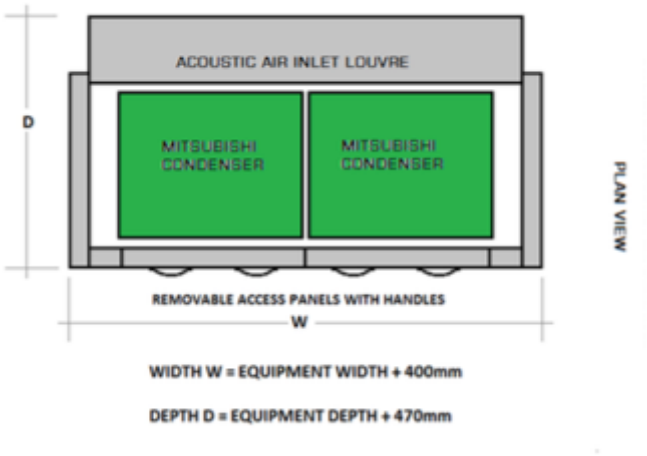
Ambient Acoustics - Package Attenuators – Typical Installation for Mitsubishi Chillers

(Acoustic Performance Data: Mitsubishi EP350+EP450, free-standing, 12dBA reduction)

Size -3400mmW x 1200mmFTB x 2157mmH



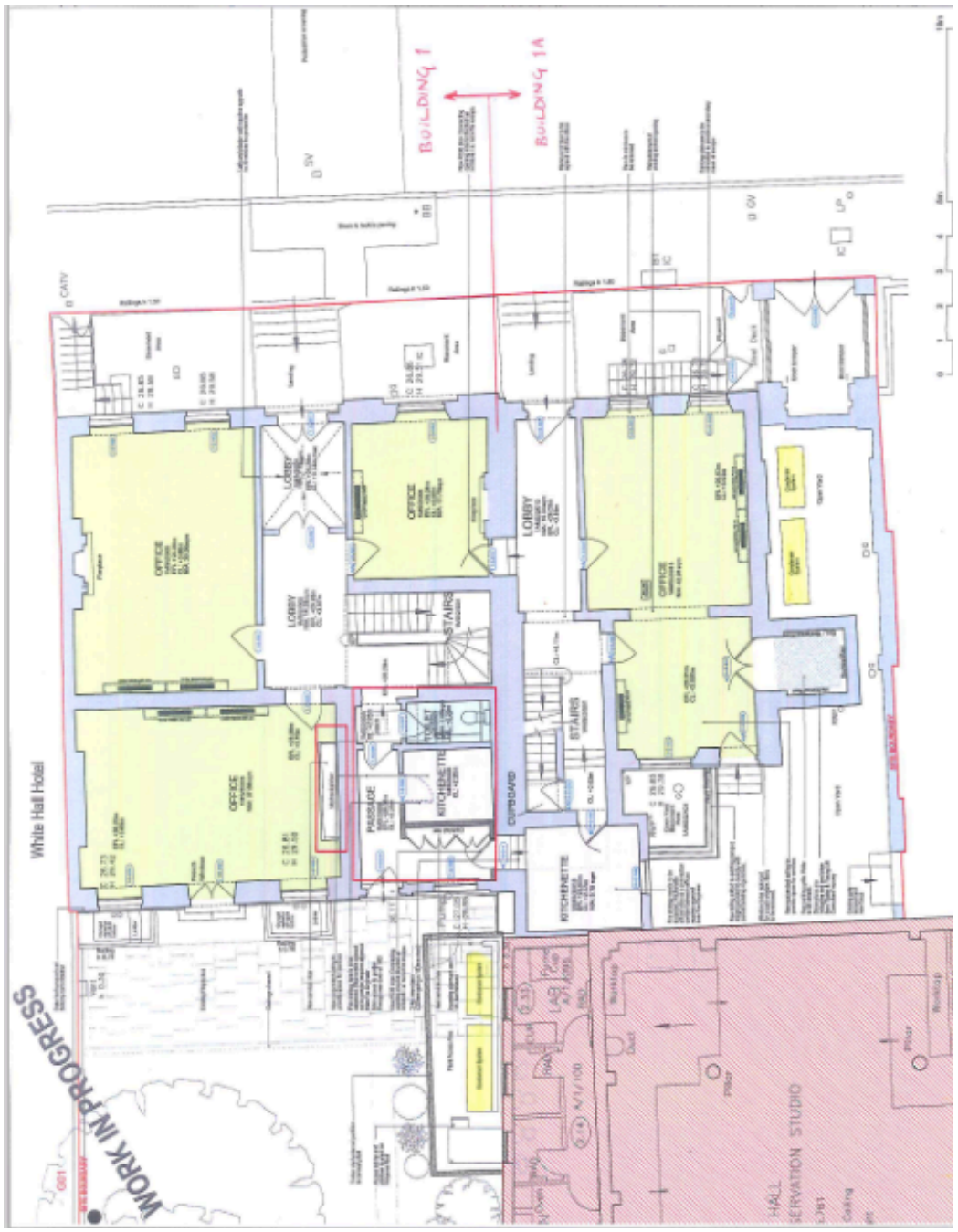
Attenuators - Elevation View



Attenuators – Plan View

Attenuators – Proposed Visual Screen I

11.0 Appendix 3 - Design Scheme Extract



12.0 Appendix 4 - Glossary of Acoustic Terms

Sound is measured in decibels (dB). To establish a reference framework it is useful to consider two noise levels which are at the extreme ends of the range to be considered. At the low end, 35 to 40 dB (A) is the normal noise level in a quiet living room, 35 dB (A) is the noise level given as a target for suburban bedrooms by the Wilson Report; a government report on noise published in 1963. At the high end is the noise level experienced at the pavement edge of a busy city centre street, a level of 75 to 80 dB (A).

The sensitivity of the human ear varies with pitch or frequency. The designation "A" used in this assessment simply means that the noise level was measured using a meter which is able electronically to respond very closely to the performance of the human ear.

Decibels are measured using a logarithmic scale, and therefore two numerically equal values cannot be added together arithmetically. Two equal noise levels occurring together form a new level which is 3 dB (A) higher than either alone. Thus two identical vehicles each producing 65 dB (A) outside someone's window will produce, not 130 dB (A), but 68 dB (A) if both engines are running together at the same distance from the microphone.

If one sound source is 10 dB (A) below an adjacent louder source, then the combined effect will be virtually no different to the louder one alone.

Experiments have shown that most people will indicate that a sound has become twice as loud, when on a measuring meter it has risen by about 10 dB (A). Also it is generally accepted that a difference in 3 dB (doubling in energy terms) is the smallest incremental step that can be distinguished by the average human ear.

Some additional acoustic terms are also referred to in this report. These are:

LA10: is the noise level just exceeded for 10% of the measurement period, and calculated by statistical analysis.

L_A90. This is the sound level exceeded for 90% of a time interval T. L_A90 and it is termed background sound or noise level. It is effectively a measure of the minimum noise level which is experienced in the absence of specific noisy events such as brake squeal or engine backfire.

$L_{A\ eq(T)}$ is the equivalent continuous sound level over a time T, which can be described as the "energy - average" noise level.

L_A max is the highest noise level recorded by the measuring meter during a single event e.g. overlying aircraft. In this assessment the meter was set to "fast" response.

Ambient Sound - This is the all encompassing sound at a given location at a within a specified time frame and comprises the sound from all near and distant sources.

Noise - Noise was defined in the Wilson Report on 1964 as "unwanted sound'. Noise excluded vibration, except where indicated otherwise.