



BRAIDEN ACOUSTICS LTD

Innovation Forum // 51 Frederick Road // Salford // Manchester // M6 6FP

RESIDENTIAL ACOUSTIC SURVEY

Prepared For : The Thackeray Estate.

Date : 5 Oct 2021

Site : 17 Piccadilly Gardens, Manchester

Report No. : 10916revB

1 INTRODUCTION

Braiden Acoustics has been commissioned by The Thackeray Estate. to undertake an acoustic survey at the site of 17 Piccadilly Gardens, Manchester in order to support a planning application for a change of use from offices to residential apartments.

The original report, dated 10th June 202, included noise measurements that were done internally and also during a partial lockdown. This revised report has external noise measurements that were recorded once lockdown restrictions have been lifted.

1.1 AIM

The aim of the report is to describe the site and its surroundings with regards to potential noise sources affecting the site. The noise assessment, along with any recommendations, shall be also described in order that future occupants are not disturbed by noise.

2 DESCRIPTION OF SITE

The site is the first floor of a five storey building on Piccadilly Gardens in Manchester city centre.



Figure 1
Site edge red and surrounding uses

2.1 SITE LOCATION AND NEIGHBOURING USES

17 Piccadilly is on the corner of Piccadilly and Oldham Street in Manchester city centre and is therefore within a predominantly commercial area. However, there are existing residential accommodation on the upper floors of the building.



Figure 2
17 Piccadilly

2.2 EXISTING USE

The first floor is currently office space for the bank at ground floor.

2.3 PROPOSED USE

It is proposed to convert the first floor into 4no. apartments.

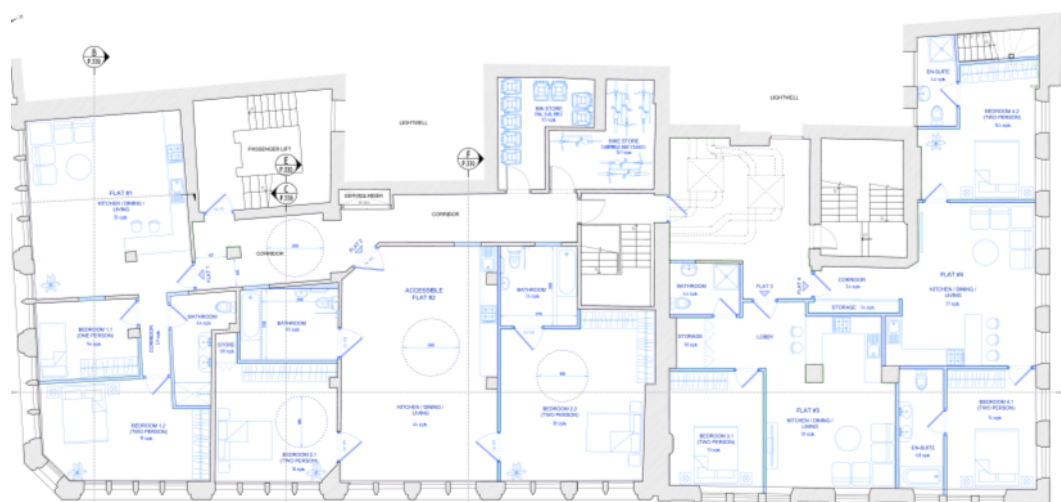


Figure 3
Site layout showing first floor plan

3 ACOUSTIC CRITERIA AND METHODOLOGY

This is a residential development that may be susceptible to environmental noise, such as road traffic noise and/or noise from local industry. Recommended noise levels due to environmental noise are taken from BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” [1] which, in turn, takes guidance from the research based World Health Organisation “Guidelines for Community Noise”. Where necessary, mitigation measures have been recommended so that the noise level thresholds are not breached.

Noise levels are usually given separately for the night-time – 2300-0700 hrs and day time – 0700-2300 hrs.



3.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

The National Planning Policy Framework is the current document for planning guidance. Paragraph 123 of the NPPF says that planning decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum, other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Unfortunately, the NPPF supersedes the previous planning guidance for noise, PPG 24, which is much more descriptive regarding noise assessments and limits; hence, PPG 24 is sometimes still used to assess a site, with relation to noise, by some Councils.

3.2 BS 8233: 2014

The British Standard BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” gives guidance on recommended indoor ambient noise levels for residential dwellings.

Room	Criterion	$L_{Aeq,T}$	
		night	day
Bedroom	Sleeping	30	35
Dining Room/Area	Dining	--	40
Living Room	Resting	--	35

Table 1

Recommending indoor ambient noise level thresholds from anonymous noise (taken from Table 4, BS 8233:2014)

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

Internal noise levels in habitable rooms are calculated using either the simple or rigorous method as described in Annex G in BS 8233:2014.

3.2.1 Noise levels in external living areas

For external living areas such as gardens and balconies, BS 8233:2014 § 7.7.3.2 recommends an upper limit of 55dB $L_{Aeq,day}$ although there is a caveat:

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.



3.2.2 Maximum noise levels

In the 2014 edition of the Standard, the criterion of 45dB L_{AFMax} inside bedrooms has been removed although there is Note 4:

NOTE 4 regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,P}$ depending on the character and number of events per night. Sporadic noise events could require separate values.

The use of the phrases ‘may be set’ and ‘could require’ imply that this is a discretionary criterion.

The L_{Amax} criterion is used where the level is not exceeded more than 10 times during the night time period.

3.3 BS 4142

BS 4142:1999 “Method for rating industrial noise affecting mixed residential and industrial areas” [2] assesses industrial noise with regards to nearby residential dwellings. The guidance is commonly used to compare the equivalent noise from an industrial source only (specific noise level), L_{Aeq} , to the background noise level, L_{A90} , at the nearest sensitive receptor (NSR).

When measuring the Background Noise Level, the Standard states:

Choose outdoor measurement locations that will give results that are representative of the ambient sound and residual sound at the assessment location(s). Make the measurement of the ambient sound level, the residual sound level and the background sound level at a height of 1.2 m to 1.5 m above the ground, unless there is a specific reason to use an alternative height (which should be justified), and under similar conditions, e.g. similar influence of reflections and measurement height above the ground. Where practical, minimize the influence of reflections by making the measurements at least 3.5 m from any reflecting surface other than the ground.

Where it is necessary to undertake measurements above ground floor level, choose a location which is approximately 1 m from the facade on the relevant floor of the building if it is not practical to make the measurements at least 3.5 m from the facade at this elevation. NOTE When measurements for distant sources are made at 1 m from a facade, the measured level can be adjusted to an equivalent free-field level by subtracting a 3 dB correction factor. For sources that are relatively close or not perpendicular to the facade the correction may be 1 dB or 2 dB, in which case the reasons for not using a correction of 3 dB ought to be explained.

Essentially, background noise measurement should be made free field. If measurements are made at the façade then a correction should be made in order to represent the free field.

This Standard has been recently updated, BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” [3]. Whereas the old standard added 5dB ‘penalty’ to the Specific Noise Level (SNL) if the noise source has a ‘character’ that can draw attention that may be described as tonal, intermittent or impulsive, the new standard gives clearer guidance on noise ‘character’. Furthermore, the previous Standard gave only one 5 dB penalty whereas the new Standard may not. When added to the specific noise level it forms the rating level. The new Standard gives the guidance for the following types of noise character:

Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.

NOTE 1 The prominence of tonal or impulsive sound from a source can be masked by residual sound. In many cases the amount of masking varies as the residual sound changes in level and possibly character. The source’s tonal and/or impulsive characteristics could also vary with time.



Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention.

Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Once a penalty for noise character is added to the Specific Noise Level then this is termed the Rating Level.

The background level is then compared to the rating level. It is usual that the rating level due to the source should be below the background noise level at the nearest sensitive receptor; indeed BS 4142 states:

“The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.”

3.4 COUNCIL NOISE CRITERIA

There are two issues of potential noise emanating from the site:

1. Environmental noise break in,
2. Noise transfer from ground to first floor and
3. Noise from external plant.

3.4.1 Residential noise criteria

For residential developments, the noise thresholds are taken from BS8233:

- Bedrooms (night time - 23.00 - 07.00) 30 dB LAeq (individual noise events should not normally exceed 45 dB LAmax,F by more than 15 times)
- Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq



- Gardens and terraces (daytime) 55 dB LAeq

3.4.2 Industrial noise criteria

For external plant the noise criterion is as follows:

‘The development should be designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location’.

4 MONITORING DETAILS

Initial monitoring has taken place internally towards the front of the building.

Follow up noise monitoring was taken one metre from a first floor windows when lockdown restrictions had eased.

4.1 VISIT 1 – INTERNAL NOISE MEASUREMENTS

4.1.1 Monitoring overview

Personnel: John Braiden, BSc & MSc Acoustics, MIOA.

Equipment: NTi XL2 integrated real time analyser & B&K 4231 calibrator.

The sound level meter was calibrated before after the measurements with no drift reported.

Monitoring was unmanned.

Noise measurements were made at one location. Background noise (L_{A90}), ‘average’ noise levels (L_{Aeq}) and maximum noise levels (L_{Amax}) were taken in 5 minute intervals.

4.1.2 Monitoring times

Noise monitoring was taken over an approximate 24 hour period.

4.1.3 Monitoring location

The microphone was internal in a front office approximately 1.2m from the ground and in the middle of the room.

4.1.4 Monitoring results

Day	Time		Duration	Time Period	L_{A90} dB	L_{Aeq} dB	L_{Amax} dB
	Start	Finish					
Wed 21/04/2021	15:32:04	23:00:00	07:27:56	day	--	37	--
	23:00:00	07:00:00	08:00:00	night	--	33	55 ¹
	07:00:00	11:06:29	04:06:29	day	---	37	--

Table 2
Summary of noise monitoring results –

¹ Level exceeded no more than 10 times.



The noise climate was predominantly road traffic noise and the ‘comings and goings’ from Piccadilly Gardens.

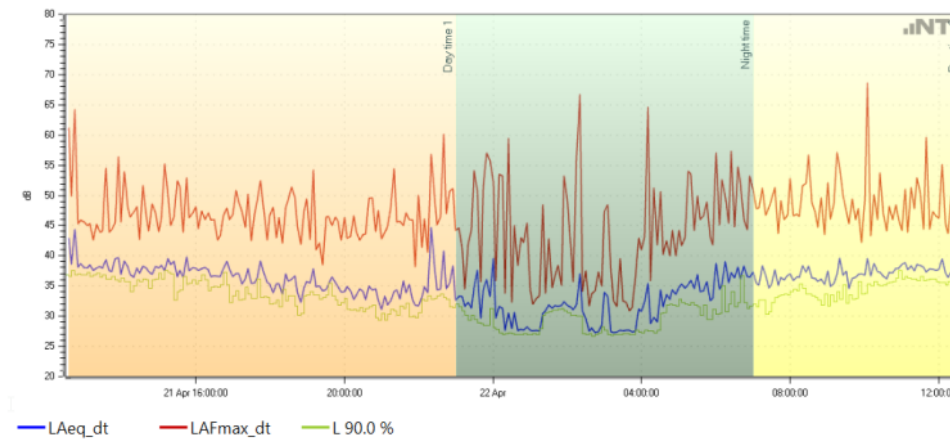


Figure 4
Time history of measured noise levels

The overall internal noise levels² are as follows:

L_{Aeq} (night) 33 dB(A)

$L_{Amax, <10}$ (night) 55 dB(A)

L_{Aeq} (day) 37 dB(A)

4.2 VISIT 2 – EXTERNAL NOISE MONITORING

4.2.1 Monitoring overview

Personnel: John Braiden, BSc & MSc Acoustics, MIOA.

Equipment: NTi XL2 integrated real time analyser & B&K 4231 calibrator.

The sound level meter was calibrated before after the measurements with no drift reported.

Monitoring was unmanned.

Noise measurements were made at one location. Background noise (L_{A90}), ‘average’ noise levels (L_{Aeq}) and maximum noise levels (L_{Amax}) were taken in 5 minute intervals.

4.2.2 Monitoring times

Noise monitoring was taken over an approximate 24 hour period.

4.2.3 Monitoring location

The microphone was externally location 1m from an upper floor window facing Oldham Street.

4.2.4 Monitoring results

² These levels were measured internally at the front of the building.



Day	Time		Duration	Time Period	L_{A90} dB	L_{Aeq} dB	L_{Amax} dB
	Start	Finish					
Mon 02/08/2021	13:41:16	23:00:00	09:18:44	day	51.7	63.6	87.2
	23:00:00	07:00:00	08:00:00	night	44	58.3	94.4
	07:00:00	09:33:05	02:33:05	day	49.4	69.7	86.7

Table 3
Summary of noise monitoring results

The noise climate was predominantly road traffic noise and the ‘comings and goings’ from Piccadilly Gardens and Oldham Street.

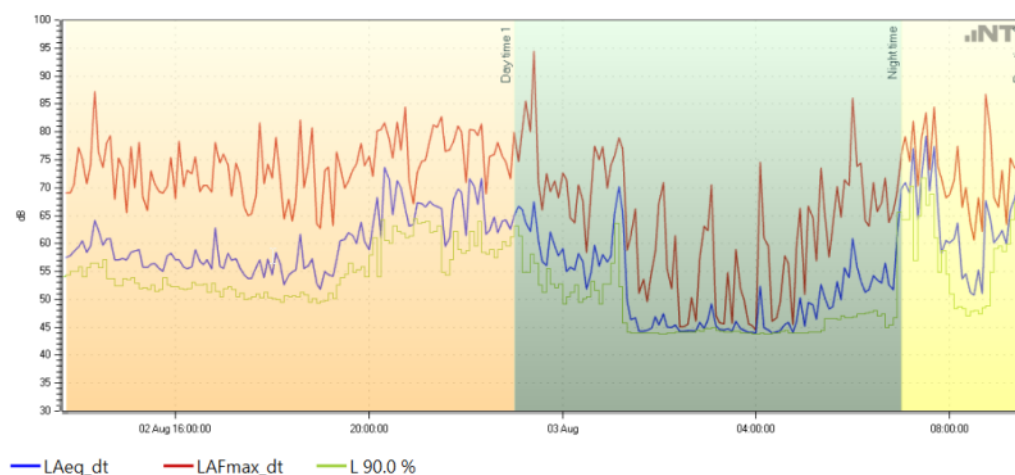


Figure 5
Time history of measured noise levels

The overall external free field noise levels³ are as follows:

$$L_{Aeq}(\text{night}) \quad 59 - 3 = 56 \text{ dB}$$

$$L_{Amax, <10}(\text{night}) \quad 78 - 3 = 75 \text{ dB}$$

$$L_{Aeq}(\text{day}) \quad 66 - 3 = 63 \text{ dB}$$

5 ACOUSTIC ASSESSMENT

5.1 INTERNAL NOISE LEVELS

5.1.1 Noise break-in

The required internal noise levels are given in Section **Error! Reference source not found.** and the amount of attenuation from the building façades were readily computed using the simple method in Appendix G of BS 8233:2014 whereby the sound insulation index (SRI) of the glazing (the weakest element of the building

³ These levels were measured internally at the front of the building.



façade, acoustically) is determined by simply deducting the required internal noise level from the external free field noise level⁴.

A -3dB façade correction was necessary as the noise monitoring was at the façade.

No distance attenuation required as noise monitoring was taken at the location of the front façade.

There is no barrier correction due to direct line of sight to the road.

All elevations shall be assessed using the same data.

The weakest structural element is the glazing. The required glazing was calculated using recommended internal values and the external façade noise levels above. The Table below shows the required Sound Reduction Indices (SRI) for the bedrooms (night) and living areas (day) on each relevant elevation.

Façade	period	room	External Levels measured / calc'd		Internal Levels recommended		Required glazing	
			L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}	SRI	Example Spec ⁵
			(dB)	(dB)	(dB)	(dB)	$(R_w + C_{tr})$	
ALL	night	bedroom	56	75	30	45	30	n/a
	day	lounge	63	--	35	--	28	n/a

*Table 4
Calculated SRI values and recommended glazing*

The current glazing is single glazed sash windows with relatively modern metal framed secondary glazing to give an approximate build up of 4 / 75 / 4mm. According to Insul, the sound insulation prediction software, the currently glazing could achieve 32 dB $R_w + C_{tr}$ which would be sufficient.

5.2 INTERNAL NOISE TRANSFER

The performance of the floor should be at least **50 dB $D_{nT,w} + C_{tr}$** which assumes an upper noise level of 80dB within the ground floor unit and 30 dB within a bedroom.

5.2.1 Separating floor design proposal

5.2.1.1 Ceiling

It has been proposed that the ceiling within the restaurant is constructed using a MF ceiling on acoustic hangers with 100mm acoustic quilt in the void and two layers of 15mm Soundbloc to form the acoustic ceiling - as follows:

⁴ When the measured levels are façade levels, then 3dB is deducted to obtain the free field levels.

⁵ Example glazing build up and performance from Saint Gobain – table in Appendix. Other glazing build-ups available.



- make good the soffit and fill all large holes and gaps with equivalent materials and appropriate methods
- add another layer of acoustic plasterboard to the underside of ceiling
- from the floor above, remove floorboards and friction fit TNF 70 acoustic slabs
- seal any gaps between floorboards with acoustic sealant or, alternatively, replace floorboards with 18mm T&G chipboard or plywood deck
- 30mm Karma Masspanel (18mm sanded cement bonded particle board with 12 mm wood fibre integral resilient layer – install as per manufacturer’s recommendations)

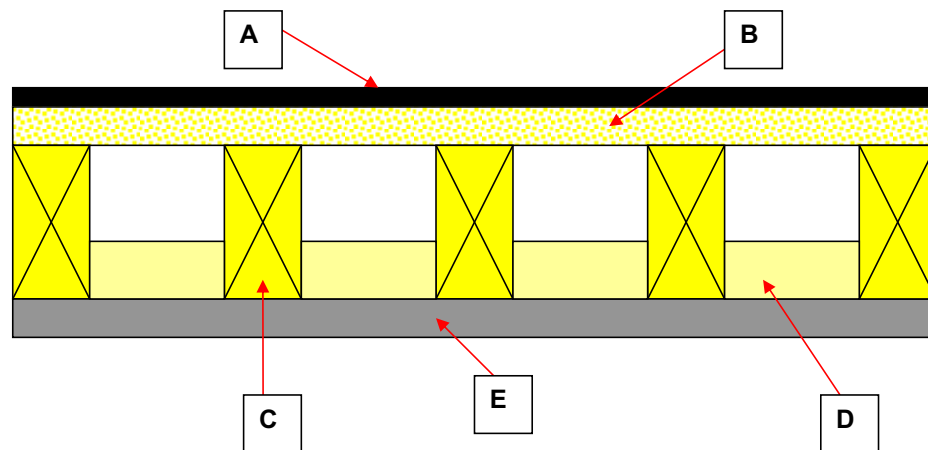


Figure 8
Floor build up

A = Karma Masspanel floor system

B = TYPICAL 18mm T&G CHIPBOARD OR PLYWOOD DECK OR SEALED FLOORBOARDS (NO GAPS)

C = TIMBER JOISTS

D = 70mm THICKNESS KARMA TNF FIRE COATED SLAB FRICTION FITTED BETWEEN JOISTS AND SEALED WITH KARMA EX240 SEALANT

E = CEILING (see previous section)

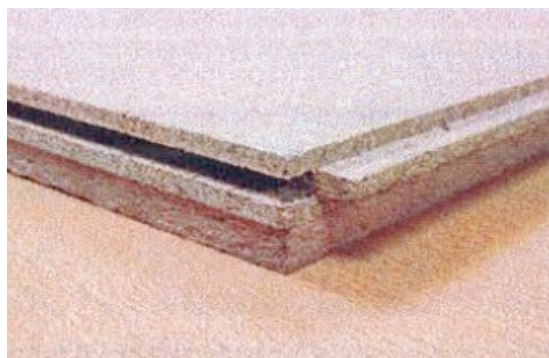


Figure 9
Karma Masspanel

The above flooring system should give an on-site sound insulation value of at least 53 dB $D_{nT,w} + C_{tr}$ (see Appendix for test result).

5.2.1.3 Separating floor construction advice

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The following construction recommendations should be strictly followed to ensure the acoustic integrity of the separating floor.

- fill (with acoustic sealant) all joints between plasterboards.
- joints should be staggered between board layers.
- leave 2-3mm around the perimeter to allow for movement and fill with a bead of acoustic sealant.
- penetrations in the acoustic ceiling should be kept a minimum (preferably none at all) but where there are then cable penetrations in the acoustic ceiling should be completely filled with acoustic sealant.
- downlighters are NOT to be used in the acoustic ceiling.
- beams / pipework that penetrate the acoustic ceiling should be boxed in with TWO layers of acoustic plaster board with 25mm acoustic mineral wool ***laid loosely*** in the cavity within the boxing in.

5.3 EXTERNAL PLANT NOISE

The proposed plant for the ground floor restaurant will be within a ground floor plant area and via first floor louvre, as shown in Figure 10. However, according to Figure 3, there will be no habitable rooms on the western (rear) elevation. Therefore, due to high background noise levels, distance and no direct line of sight then there should no issue of noise from external plant having any adverse effect on future residents.

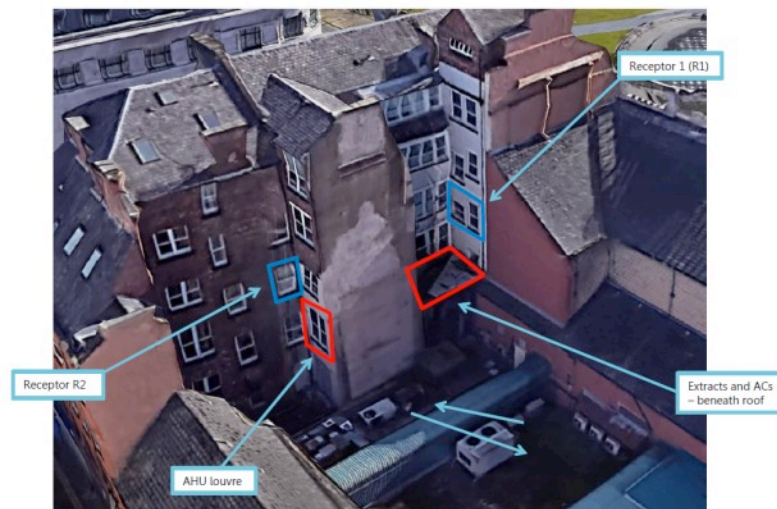


Figure 10
Proposed plant for proposed ground floor restaurant

6 CONCLUSION

An acoustic survey has taken place at 17 Piccadilly Gardens, Manchester to support a planning application for apartments on the first floor.

The current secondary glazing is sufficient. However, the existing windows and secondary glazing all need to be checked to make they work properly and make a tight seal when closed. The same for the secondary glazing.



The separating floor should be at least 53 dB $D_{nT,w} + C_{tr}$. The Karma Masspanel and TNF70 acoustic slab combination has been suggested along with a dummy ceiling for services.

There are no habitable rooms on the western elevation where the external plant will be located for the proposed restaurant. Therefore, due to high background noise levels, distance and no direct line of sight, then there should be no issue of noise from external plant having any adverse effect on future residents.

7 REFERENCES

- [1] BS8233: 2014
Guidance on sound insulation and noise reduction for buildings
British Standards Institute, 2014.
- [2] BS 4142: 1997
Method for Rating industrial noise affecting mixed residential and industrial areas
British Standards Institute, 1997.
- [3] BS 4142: 2014
Methods for rating and assessing industrial and commercial sound
British Standards Institute, 2014.



Appendix

A1 BS 12354-3:2000 – Glazing spec

Table B.1 - Examples of the sound reduction index of glazing

Glazing type	Sound reduction index (dB)						
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	R_w (C; C _{tr}) dB
Single panes (mm)							
3	14	19	25	29	33	25	28 (-1; -4)
4	17	20	26	32	33	26	29 (-2; -3)
5	19	22	29	33	29	31	30 (-1; -2)
6	18	23	30	35	27	32	31 (-2; -3)
8	20	24	29	34	29	37	32 (-2; -3)
10	23	26	32	31	32	39	33 (-2; -3)
12	27	29	31	32	38	47	34 (0; -2)
Laminated panes (mm) + plastic laminate (0,5 to 1) mm							
6+	20	23	29	34	32	38	32 (-1; -3)
8+	20	25	32	35	34	42	33 (-1; -3)
10+	24	26	33	33	35	44	34 (-1; -3)
Double pane units with single or laminated panes (mm); air filled cavity from (6 to 16) mm							
4-(6-16)-4	21	17	25	35	37	31	29 (-1; -4)
6-(6-16)-4	21	20	26	38	37	39	32 (-2; -4)
6-(6-16)-6	20	18	28	38	34	38	31 (-1; -4)
8-(6-16)-4	22	21	28	38	40	47	33 (-1; -4)
8-(6-16)-6	20	21	33	40	36	48	35 (-2; -6)
10-(6-16)-4	24	21	32	37	42	43	35 (-2; -5)
10-(6-16)-6	24	24	32	37	37	44	35 (-1; -3)
6-(6-16)-6+	20	19	30	39	37	46	33 (-2; -5)
6-(6-16)-10+	24	25	33	39	40	49	37 (-1; -5)
NOTE 1 This selection and the values are in accordance with prEN 12758-1. The single number ratings are deduced from results in 1/3-octave bands and therefore single number ratings deduced from the given octave band data might result in values which differ 1 dB at the most.							
NOTE 2 Though it is known that for a given double pane unit the sound reduction increases with increasing cavity width, this effect has been found to be too small to take into account here for air filled cavities in the light of the inherent spread in results for nominally identical units.							



Product Data Sheet

KARMA TNF Fire and Acoustic System for Timber Floors

Description :-

Very high-density stone-fibre batts of 1200 x 600 x 70mm, white coated on the top side with a smoke and fire resistant sealant. These are cut to suit on site and fitted between joists after the removal of the covering floor boards. They are secured under compression and bonded with Karma EX240 Intumastic.

Application :-

Used to upgrade the fire resistance of timber floors to 90 minutes fire integrity and insulation. Often used where a lath and plaster ceiling must not be disturbed or where access is not possible from the soffit face because of occupancy of a dwelling or congestion caused by mechanical services.

Fire Rating :-

Tested to BS 476 Pt 22.90 minutes fire integrity and insulation.

Benefits :-

1200 x 600mm size covers most joist centres.
Installed without the need for any mechanical fixing.
Very lightweight system that is quick to install.
A dry system that will not damage sensitive lath and plaster ceilings or fine plaster mouldings.



Product Data Sheet

KARMA TNF Fire and Acoustic System for Timber Floors

Installation

- 1) Locate and review KARMA TNF FIRE AND ACOUSTIC SYSTEM FOR TIMBER FLOORS Health and Safety notes before commencing work.
- 2) Lift sufficient floorboards to allow KARMA TNF FIRE AND ACOUSTIC SYSTEM FOR TIMBER FLOORS to be installed.
- 3) Clear any remaining pugging from the ceiling/floor void and clear dust from the sides of the joists to improve the adhesion of the bonding KARMA EX240.
- 4) Apply a 10mm bead of KARMA EX240 to the side of each joist 35mm from the bottom. If adhesion is difficult, spray the joist with water from a small garden spray.
- 5) Measure the gap between joists and cut an KARMA TNF FIRE AND ACOUSTIC BATT to fit tightly (**WHITE COATED SIDE UP**). **Maximum unsupported length – 600mm.**
- 6) Place loosely in position at 45° between joists. Using a timber board to spread the load, ease into the final position using gentle foot pressure.
- 7) When finally positioned, apply a 5mm bead of KARMA EX240 all around the seal and on any butt joints.
- 8) Inspect and check work and re-fix floorboards.



