Chartered Building Consultancy

Acoustic South East

Noise Impact Assessment

Client:	**Moretons Investments Limited**
Site Address:	**30 Montague Street Worthing**
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Date Written:	**12/09/2024**
Issue 1	
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Report by: George Orton BEng (Hons) MIOA

Issue 1	12/09/2024

1 Summary and Conclusion

Acoustic Associates have been appointed to undertake an acoustic assessment in support of a listed building planning application. The development description as detailed in the application can be seen below:

Change of use of first and second floor accommodation from Use Class E to three residential dwellings (Use Class C3), including alterations to the ground floor shopfront to form a new entrance

The purpose of this assessment is to assess noise levels affecting the proposed noise sensitive receptors (NSRs). The following has been assessed:

- Noise from existing environmental sources close to proposed development
- Noise from existing commercial and entertainment premises close to proposed development

Noise levels have been measured close to where the proposed re-development will take place.

The noise levels for the day and the night time period have been assessed in terms of and following the guidelines of the documents listed below:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- BS4142 (2014) Method for rating industrial noise affecting mixed residential and industrial areas
- ProPG: Planning & Noise (Professional Practice Guidance on Planning & Noise) 2017

Noise mitigation measures have been recommended and if they are implemented correctly the internal noise levels will achieve the guideline values detailed in ProPG, WHO and BS8233. To achieve the standard internal noise criteria secondary glazing may be required for windows overlooking Montague Street.

Achieving these criteria will result in a good acoustic environment inside the proposed dwellings. As such it is considered that the change of use would not be refused on noise grounds.

2 Context & Noise Criteria

2.1 Context

The upper floors of the building will be converted from commercial use to 3 individual dwellings. The ground floor will be retained as a commercial area (likely to be a retail unit or small café/restaurant). The noise sources affecting the proposed dwellings will be as detailed below:

- Street noise from Montague St (Front facade)
- Existing Commercial Plant (Rear facade)
- Retained ground floor commercial unit

2.2 Local Planning Guidance

Based upon the "*Planning Noise Advice Document - Sussex (November 2023)"* document, it is recommended in this case that appropriate criteria are provided by:

- BS4142 (2014+A1:2019) Method for rating industrial noise affecting mixed residential and industrial areas
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- World Health Organisation (WHO) - Guidelines for Community Noise 1999

Reference is also made to the 2017 ProPG "Planning & Noise Document" although this project may be outside the scope of the guidance (conversion dwellings and road noise is not the dominant source of noise)

2.3 BS8233 Noise Criteria

Table 5 of BS8233 provides the following guideline values:

Activity	**Location**	**Time period of day**	
		07:00-23:00	**23:00-07:00**
Resting	Living Rooms	35dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 1: BS8233 Criteria

2.4 WHO Internal Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type	**Target Maximum Internal Level - L_{Aeq} dB (A)**
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)
Room Type	**Maximum Internal Level – L_{Amax} dB(A)**
Bedrooms	45 (not more than 10-15 times per Night)

The *ProPG: Planning & Noise – New Residential Development* (2017) document has slightly more onerous criteria where L_{Amax} events should not exceed 45dBA more than ten times during the night

2.5 WHO External Noise Criteria

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.6 Building Regulations Criteria

Approved Document E of the Building Regulations (2003 Edition) specifies minimum performance values of Weighted Standardised Level Difference (DnT,w + Ctr) for airborne noise transmission through party floors and walls and Weighted Standardised Sound Pressure Level (L'nT,w) for impact sound transmission through a floor.

It should be noted that with airborne sound insulation it is the level difference that is being measured between rooms and the higher the result the better the insulation. With impact sound insulation it is the actual sound pressure level in the receiving room that is measured, and therefore the lower results, the better the insulation.

A summary of the acoustic requirements, for the conversion property, are as follows:

Requirements of:	Element	Airborne Sound Insulation (DnT,w + Ctr)	Impact Sound Insulation (LnT,w)
Commercial/Dwelling*	**Floor**	**≥48dB**	**N/A**
Bregs Dwelling/Dwelling	**Floor**	**≥43dB**	**≤64dB**
Bregs Dwelling/Dwelling	**Wall**	**≥43dB**	**N/A**

Table 2: Building Regulations Noise Criteria

** For many other projects the Local Authorities in Sussex require that the basic ADE target is exceeded when there is a commercial unit directly adjacent to a dwelling. In this case the Building Regulations+5dB target should be sufficient (ground floor units are most likely going to be retail units and will not open late as arcade is locked up at the end of the day)*

2.7 BS4142: 2014: Method for rating and assessing industrial and commercial sound

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

a) Typically, the greater the difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

d) 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 noise level, this is an indication of the specific sound source having a low impact, depending on the context.

2.8 Overheating and Acoustics

For new build properties the new Approved Document O of the Building Regulations details ways of reducing the risk of overheating. It should be noted that this conversion project would be outside of the ADO Scope.

For past projects the Local Authority have expressed concern over the risk of overheating and the problems that may occur if cooling is required via an open window that is subject to undesirable external sound levels. As such an "overheating condition" acoustic assessment has also been completed for the different proposed dwellings. To help with the assessment criteria for the overheating condition (at times when cooling is required) have been adopted based on the criteria in Approved Document O

2.8.1 ADO Criteria

The noise criteria details from the document have been copied below:

Noise

3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).

b. 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

The ANC and IOA have also created the *"Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O July 2022"* document

The document demonstrates that the noise level inside a room, with a window wide open, will be approximately 9dB lower than the outside free-field noise level (another document states that a partially open window will result in indoor noise levels 13dB lower than the external level).

2.8.2 Adopted Criteria for Overheating Condition

Taking into account the fact that ADO does not strictly apply for conversion properties any adopted criteria should not be more onerous than the criteria in the document.

For example if stricter criteria are adopted for conversion projects in town centres the only solution to achieve the criteria would be to introduce comfort cooling as other mitigation measures (smaller windows, window shading, façade ventilators etc.) are not likely to be possible (for conversion projects especially those in conservation areas or with listed facades).

The example adopted criteria for this project are as detailed below:

- Inside Bedrooms (same as ADO noise limits):
  - Less than 40dBA averaged over the 23:00-07:00hrs period
  - No more than 10 L_{Amax} events over 55dBA over the 23:00-07:00hrs period
- Inside Lounges:
  - Less than 45dBA averaged over the 23:00-07:00hrs period

Criteria for lounge areas have also been adopted for completeness (BS8233+10 as per the ADO criteria). However as the ADO document only details noise criteria for bedrooms adopting criteria for the lounge could be considered superfluous.

3 Unattended Noise Survey Baseline Conditions and Results

Two separate sound surveys have been completed prior to the conversion being completed:

- Survey Position 1 (Front façade) - 13/08/24 to the 20/08/24.
- Survey Position 2 (Rear façade) - 13/08/24 to the 20/08/24.

The survey positions can be see seen in the figure within the appendix

3.1 Details

- Survey carried out by: George Orton BEng (Hons) MIOA
- Equipment used: Castle Mirus & Svantek971 - Type1 Sound Level Meters
- Weather conditions: Sheltered location Wind speed average less than 5ms^{-1}

Meters were calibrated before and after commencing the noise measurements (@94dB no drift). The façade level survey results for both positions have been reduced by 3dB to express the results as free-field levels. All levels in this report, unless stated otherwise, will be free-field levels.

3.2 Survey Results - L_{Aeq} & L_{Amax}

The day and night time sound levels have been shown in the table below:

3.2.1 Position 1 – Front

Date	Date	Freefield Level - dBA		
		$L_{Aeq,07:00-23:00}$	$L_{Aeq,\ 23:00-07:00}$	10th Highest $L_{Amax-night}$
Tue	13-Aug		49	75
Wed	14-Aug	55	51	72
Thu	15-Aug	56	48	71
Fri	16-Aug	55	47	71
Sat	17-Aug	55	51	74
Sun	18-Aug	52	48	73
Mon	19-Aug	56	45	69
Average		**55**	**48**	**72**

Table 3: Survey 1 Results

3.2.2 Position 2 – Rear

Date	Date	Freefield Level - dBA		
		$L_{Aeq,07:00-23:00}$	$L_{Aeq,\ 23:00-07:00}$	10th Highest $L_{Amax-night}$
Tue	13-Aug		43	66
Wed	14-Aug	49	41	64
Thu	15-Aug	51	44	67
Fri	16-Aug	50	42	66
Sat	17-Aug	49	42	66
Sun	18-Aug	47	41	66
Mon	19-Aug	49	40	65
Average		**49**	**42**	**66**

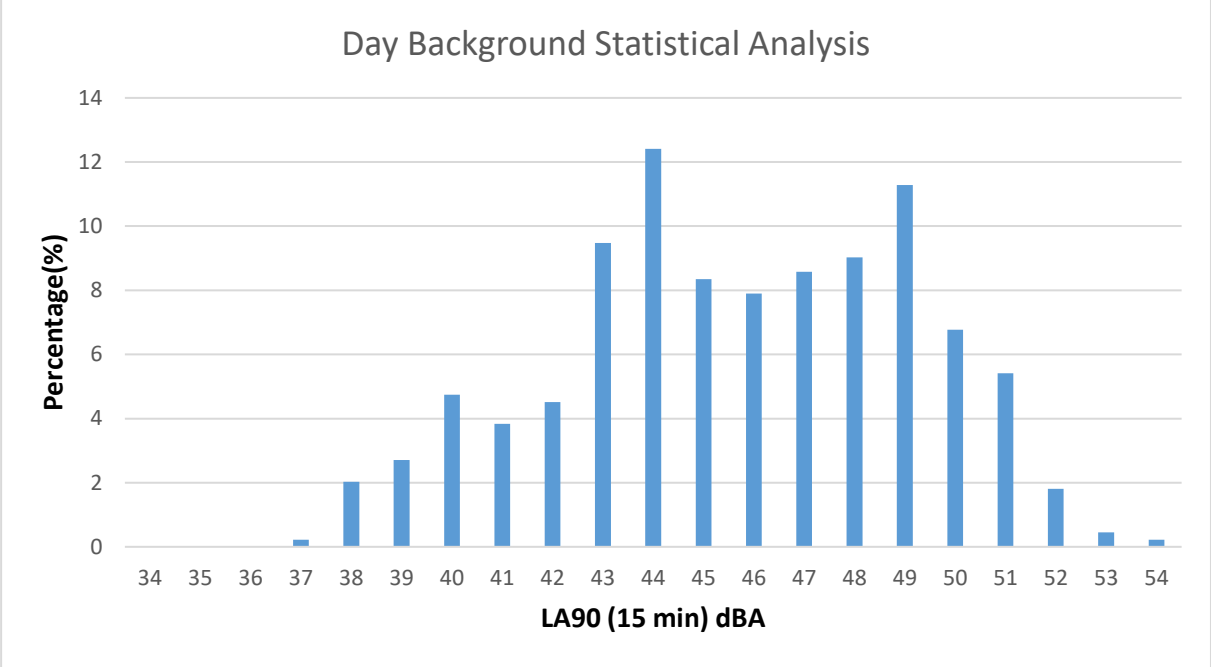
Table 4: Survey 2 Results

3.3 Survey Results - L_{A90} – Background Sound Levels

The $L_{A90,15min}$ statistical modal (most commonly occurring) graphs can be seen below. A summary of the representative background sound levels would be:

- Front
  - Daytime = 44dBA
  - Night time = 38dBA
- Rear
  - Daytime = 48dBA
  - Night time = 39dBA

3.3.1 Position 1 – Front



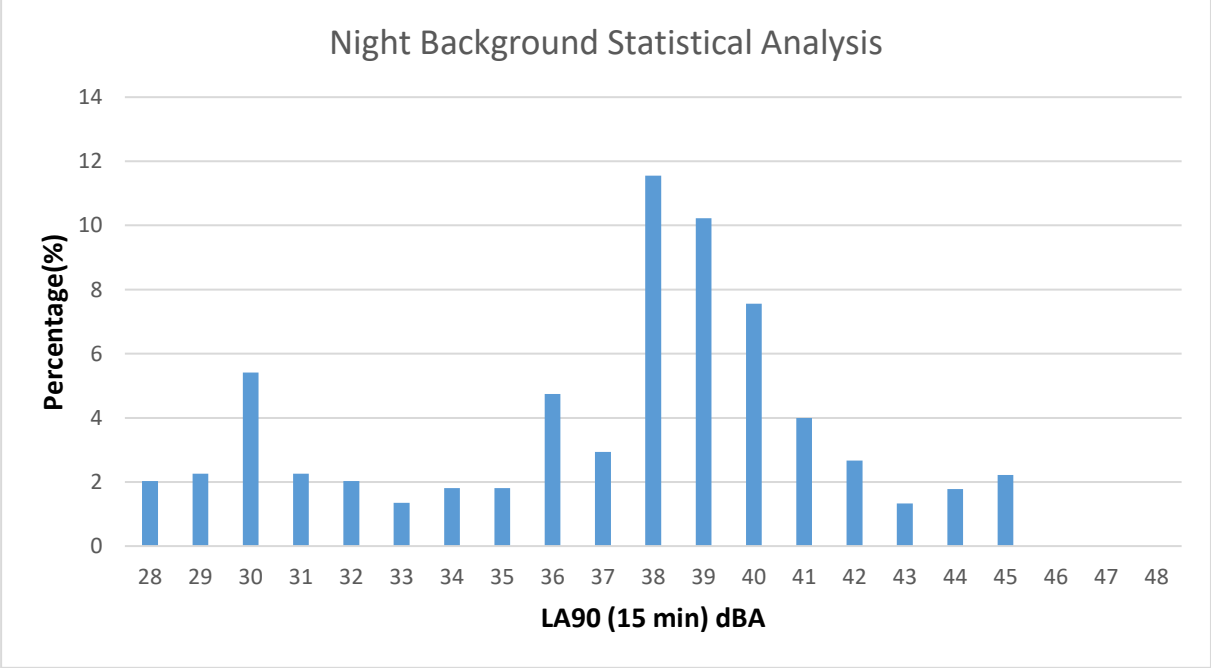
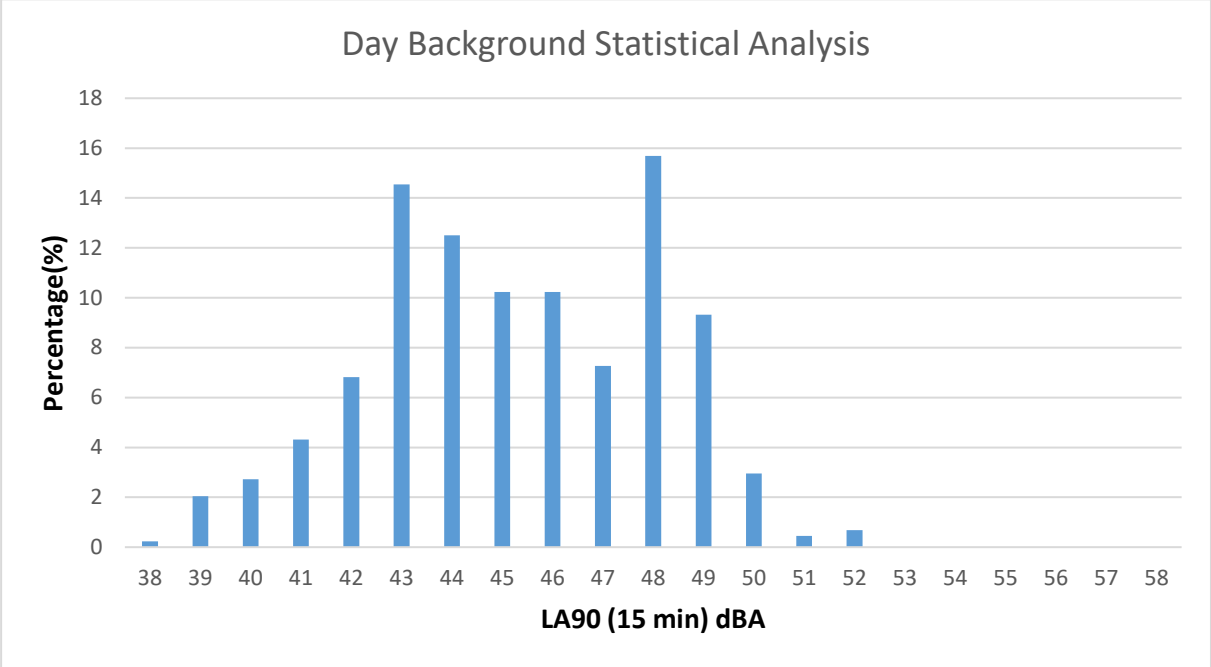


Figure 1: Position 1 Background Sound

3.3.2 Position 2 – Rear



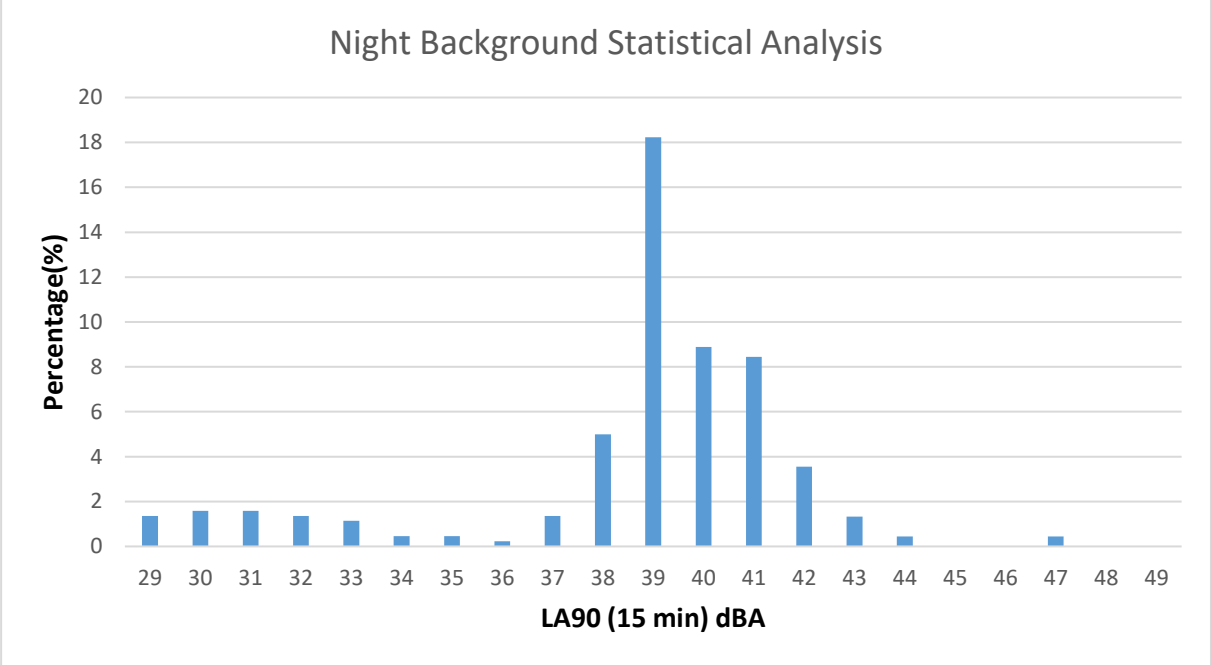


Figure 2: Position 2 Background Sound

4 Assessments

4.1 BS4142

4.1.1 Specific Sound Level

Whilst setting up the sound survey the sounds created by plant machinery were clearly audible. The plant is located rear façade of the neighbouring building (currently used as opticians)

The survey data for the weekend days have been shown below:

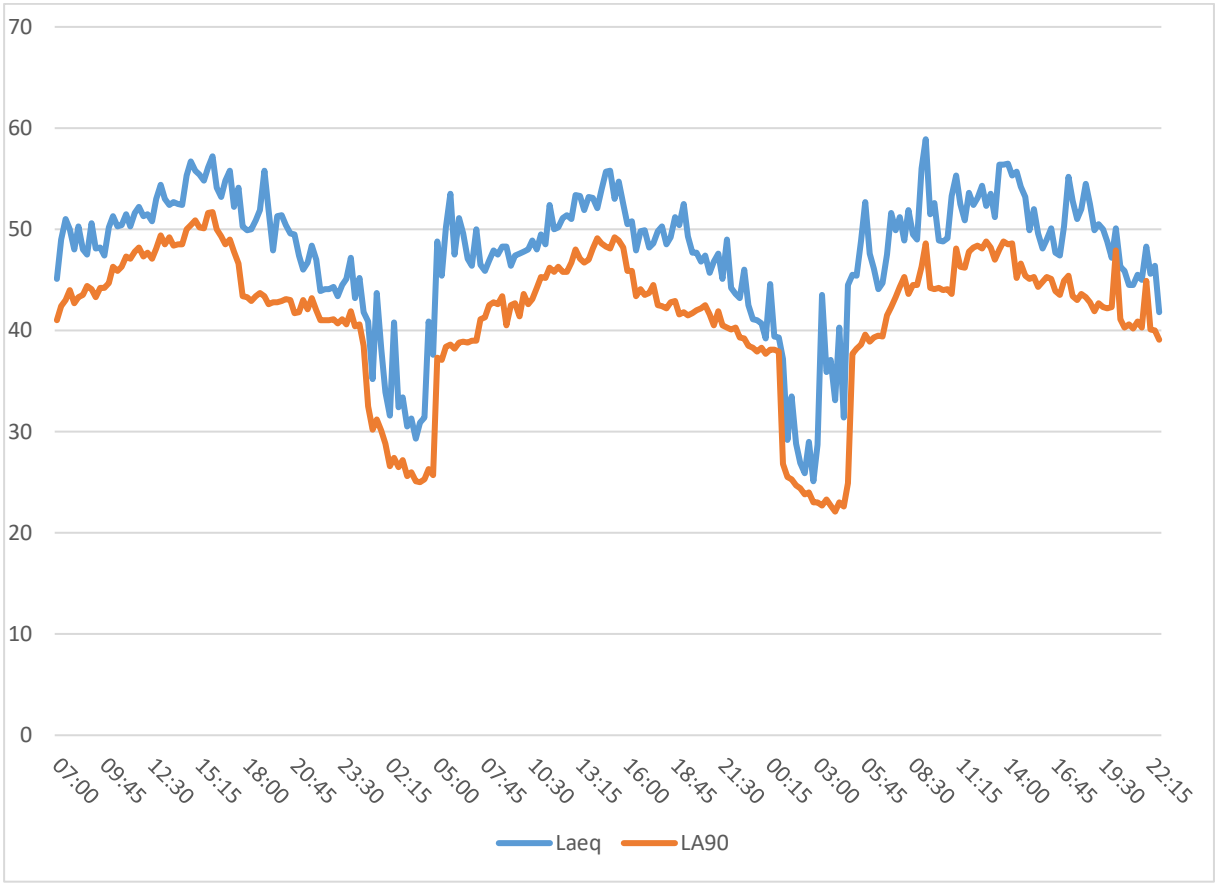


Figure 3: Sun/Mon Graph

The 15minute L_{Aeq} measurements demonstrate what would be classed as a diurnal pattern.

The background sound level does show a clear drop at shop closing time (17:00 Sat and 16:00 Sun). This may be more related to the shopping area becoming quiet as opposed to the plant switching off. If plant noise was more dominant during the day the L90 curve would likely be flatter throughout the day.

The daytime modal LA90 value (48dBA) may be acceptable to use as the specific sound level for the Heatpump plant that operates at a fairly steady level. Looking at the rear position results it is unlikely that the plant operates at night time

4.1.2 Background Sound Level

The survey data at the front (away from the plant at the rear) was used to find the most commonly occurring background sound level:

- Daytime $L_{A90,15min}$ = 44dBA

It is possible that the $L_{A90,15min}$ levels at the front are marginally higher than at the rear. However the weekend graph above indicates the background sound level after closing time is around 43dBA. As earlier in the day the level would be higher the 44dBA modal value will be used for the assessment.

4.1.3 Rating Level

The sounds created by the AC plant were not considered to be highly tonal. A 3dB correction will be applied to err on the side of caution.

4.1.4 Assessment

The rating level of 51dB (48+3) is 7dB over the representative background sound level.

The Standard provides guidance that a difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The context points, that may reduce the possibility of adverse impacts, are as follows:

- Plant only operates during the day
- The occupants will move in to the dwellings with the plant operational (as opposed to new plant next to existing dwellings)
- Specific sound levels are fairly modest so basic mitigation measures would be able to reduce noise ingress to an acceptable level)

4.2 WHO/BS8233 Noise Assessments

To further assess the likely noise impact, upon nearby NSRs, guidelines and standards, other than BS4142, can also be used

4.2.1 Criteria

Based on BS8233/WHO the maximum internal/external noise level for each area is as follows:

- Bedrooms ≤35/30dBA Day/Night (Inside)
- Bedrooms ≤10 events, per night, over L_{Amax} 45dB (Inside)
- Lounges ≤35dBA Day (Inside)
- Outdoor Areas ≤50dBA (N/A as there are no external amenity areas)

4.2.2 Distance Corrections

For the front façade sound survey the microphone was outside the second floor. For the 1st floor (closer to the street level) a 4dB increase in sound levels will be applied (worst case points source correction for 4.5m to 7.5m distances)

For the rear sound survey no corrections will be applied as the survey microphone was at the top of the first floor window.

4.2.3 Required Sound Reduction

In order for the BS8233 and WHO criteria to be achieved the building envelope will have to achieve the following levels of sound insulation (SRI). For the LAmax SRI the sound reduction is based on achieving an average of no more than 10 events over 45dBA per night (ProPG criteria). The required sound reduction levels are detailed in the table below:

Floor	Facade	Room	Ext level dBA Day/Night/max	Required Sound Reduction		
				07:00-23:00	23:00-07:00	$L_{Amax-night}$
1	Front	Lounge	59	24		
1	Front	Bedroom	59/52/76	24	22	31
2	Front	Lounge	55	20		
2	Front	Bedroom	55/48/72	20	18	27
1	Rear	Lounge	49	14		
1	Rear	Bedroom	49/42/66	14	12	21
2	Rear	Bedroom	49/42/66	14	12	21

Table 5: Required Sound Reduction

5 Mitigation Measures – Normal Condition

As this report has been completed at the planning stage only generic mitigation measures have been recommended. During the detailed design phase specific measures will be incorporated into the design so the criteria can be achieved. To help with specifying the mitigation measures the following table has been copied from the AVOG guide. The table estimates the sound façade reduction values for different glazing and ventilation scenarios:

Table B-2 Potential level differences associated with different ventilation Systems from ADF

Ventilation System from ADF	Cont. equiv. (L_{Aeq}) or events (L_{AFmax})	Level Difference, external free field level – internal reverberant level, dB	
		Typical windows and vent	Higher acoustic performance windows and vent
1, 2	L_{Aeq}	21	31
	L_{AFmax}	22	35
3 (with trickle vent)	L_{Aeq}	23	33
	L_{AFmax}	24	38
4 (no trickle vent)	L_{Aeq}	27	38
	L_{AFmax}	31	45

Figure 4: AVOG Table B2

5.1 Glazing & Ventilation

For the bedrooms and lounges facing onto Montague Street, in order to achieve the levels in table 5 above, secondary glazing will have to be installed (As it is understood that the existing single glazed sash units are to be retained).

For the rear façade the maximum sound reduction required is only 21dB. Based on the AVOG table standard double glazing should be acceptable (existing windows could be retained or modified so the R_w+C_{tr} achieves at least 31dB).

5.2 Whole House ADF Ventilation

A ventilation strategy will have to be developed at the detailed design stage that achieves the ADF ventilation rates. Irrespective of the noise climate the whole house ventilation system will not rely on open windows to provide the correct ventilation levels. Based on the AVOG table a strategy with trickle vents would be possible in terms of acoustics. However the listed nature of the property may require a ducted system with inlets/outlets on a façade that not deemed aesthetically important.

6 Mitigation Measures – Overheating Condition

At this stage a full overheating assessment has not been completed.

To achieve the adopted overheating criteria (BS8233/ProPG +10dB as in ADO) the sound reduction required will be 10dB lower than as detailed in the table in the previous section.

The required sound reduction therefore would be as detailed below

Floor	Facade	Room	Required Sound Reduction Overheating Condition		
			07:00-23:00	23:00-07:00	$L_{Amax\text{-}night}$
1	Front	Lounge	14		
1	Front	Bedroom	14	12	21
2	Front	Lounge	10		
2	Front	Bedroom	10	8	17
1	Rear	Lounge	4		
1	Rear	Bedroom	4	2	11
2	Rear	Bedroom	4	2	11

Table 6: Required Sound Reduction - Overheating

The above shows that the overheating strategy could include the following points (if required as both facades are fairly sheltered/shaded by other nearby buildings):

- Front Façade
  - Higher noise levels so criteria achieved with windows closed or secondary glazing acting as plenum
  - Low G secondary glazing (to reduce thermal gains)
- Rear Façade
  - Daytime criteria achieved with wide open window
  - Night time achieved with partially open window

It should be noted that even in high noise areas the strategy could still implement open windows for certain periods of time. For example one strategy, for a bedroom, may include open windows during the day (when unoccupied) and closed windows at night (to prevent sleep disturbance)

7 Sound Insulation of Internal Partitions

This report is required to be submitted prior to the commencement of the development. As such the detailed design has not been completed.

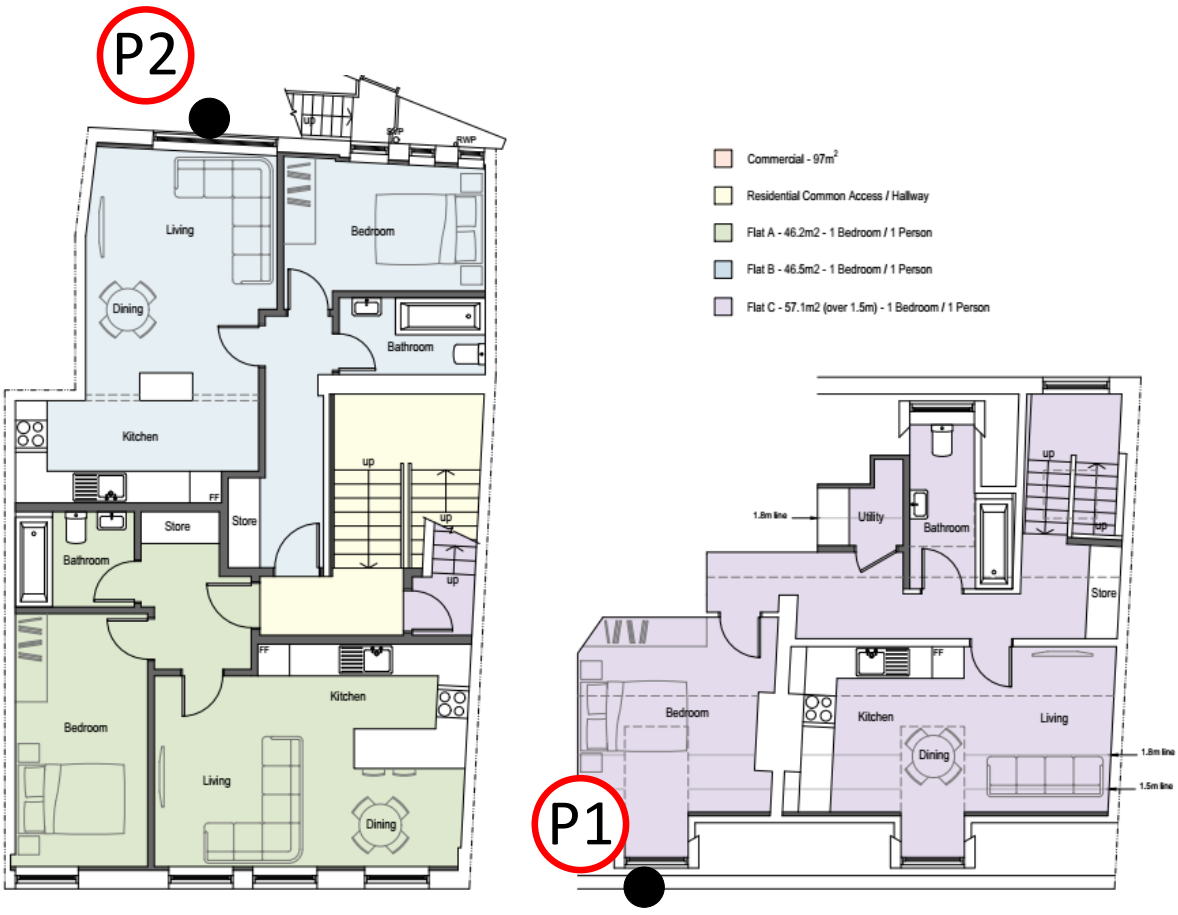
The sound insulation of the floor will be upgraded to achieve at least $D_{nT,w}+C_{tr}$ ≥48dB (assuming the ground floor is a retail unit as opposed to a café/bar etc.)

To reduce sound transfer from the ground floor retail areas, to the new dwellings above, new suspended ceilings are to be installed. Services and lighting are to be surface mounted below the fire/acoustic ceiling. Two example specifications have been detailed below:

- Independent Timber Ceiling
    - Over boarded existing floorboards (or new 22mm Chipboard/Ply)
    - Existing timber joists
    - Existing Ceiling (made good if damaged) or 15mm Fireline to underside of joists
    - 100mm acoustic mineral wool or Rockwool
    - Independent timber joists (mid span resilient hangers if required)
    - 2x12.5mm Soundbloc

- Metal Furring (MF) Ceiling
    - Over boarded existing floorboards (or new 22mm Chipboard/Ply)
    - Existing timber joists
    - Existing Ceiling (made good if damaged) or 15mm Fireline to underside of joists
    - 100mm acoustic mineral wool or Rockwool
    - MF Ceiling on resilient hangers
    - 2x12.5mm Soundbloc

8 Appendix



Proposed 1st Floor

Proposed 2nd Floor

Montague St

Figure 5: LT Survey Locations