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Noise Impact Assessment of Proposed Residential/Commercial Development to Support Planning Application

Prepared for: *Masala Bazaar Ltd*
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NP20 2PL

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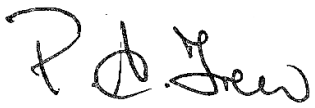

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BRIEF FOR CONSULTANCY:

This report has been prepared by Acoustics & Noise Limited, Newport, South Wales, for Mr. Shelim Hussain, Masala Bazaar Ltd. under the instructions of Mr. David Pugh.

Order No: n/a

OBJECTIVES:

To investigate the noise impact on the proposed development at 170 – 172 Commercial Road, Newport.

Where applicable recommend mitigation to meet the impact criteria.

NON-TECHNICAL SUMMARY:

It is proposed to develop 170 – 172 Commercial Road for mixed residential/commercial use.

A former office building at the rear of the site is to be converted into 8 flats on the first and second floors. The existing ground floor was previously occupied by a Kwik Save supermarket and is to be renovated and upgraded as a supermarket.

This report contains an assessment of the impact of external noise on the internal ambient noise of the proposed flats.

Whenever possible, it is desirable to open the windows to provide background ventilation, and this assessment indicates that with a partially open window to provide background ventilation, the predicted internal noise levels within the bedrooms of Flats 1 and 5, and within the lounge/dining/kitchen of Flats 6 and 8, will exceed the guideline values detailed in BS 8233 [2].

To achieve the guideline internal ambient noise levels within these rooms, sound mitigation measures are recommended using standard thermal 4/20/4 glazing, in the closed position. There is no requirement for these windows to be permanently closed.

The guideline values for internal ambient noise levels as detailed in BS 8233 [2] can be achieved within the remaining habitable rooms using a partially open window to provide ventilation.

For all rooms where sound mitigation is recommended, an alternative means of ventilation may be required. It is important that any scheme of ventilation does not compromise the façade sound insulation, or the resultant internal noise levels and Building Control should approve any such scheme.

At the time of preparing this report, confirmed details of any proposed plant associated with the commercial development were unavailable. In the absence of these plant details, an assessment of potential impact has been completed using data from a range of suitable plant.

It is proposed to locate the plant on the roof of the refurbished supermarket at the centre of the boundary between the supermarket and flats.

The sensitive receptor is located within the bedroom of flats 1 or 5, which are subject to the recommended sound insulation measures described above.

This report concludes that, following consideration of the context of the proposed plant installation, the impact at the sensitive receptor within the bedrooms of flats 1 and 5 will be low.

1.0 DESCRIPTION OF SITE

1.1 The site is located at 170 – 172 Commercial Road, Newport, NP20 2PL and is currently a vacant property comprising a commercial unit at the front of the site with a two-storey building at the rear.

1.2 The site is in a predominantly mixed residential/commercial area and is bounded by Commercial Road to the east with an adjacent car park to the south.

1.3 The commercial building at the front of the site was formerly used as a supermarket with the two-storey building utilised as office space.

2.0 DISCUSSION

2.1 It is proposed to develop the site for mixed residential/commercial use.

2.2 The former office building is to be refurbished as 8 flats, located on the first and second floors.

2.3 The former Kwik Save supermarket is to be renovated and upgraded as a supermarket.

2.4 The noise climate at the site was dominated by road traffic noise from Commercial Road, with lesser contributions from the use of the Car Park. The noise climate was also influenced by frequent, unsociable activities within the immediate area.

2.5 Acoustics and Noise Limited requested a scoping opinion from Ms Abbie Thomas, Environmental Health Officer with Newport City Council.

2.6 An email from Ms Thomas stated *"any residential proposal for 170-172 Commercial Road will require a BS 4142:2014 assessment and BS 8233 noise report".*

2.7 Acoustics and Noise Limited were engaged by Masala Bazaar Ltd., to complete a noise impact assessment to satisfy the above requirements of Newport City Council.

3.0 ASSESSMENT METHODOLOGY

3.1 Relevant Guidance

3.1.1 As a matter of best practice, this assessment has been undertaken based on the relevant guidance on noise. This includes:

3.2 Objective Assessment using BS4142 [1]

3.2.1 General guidance

3.2.1.1 The Foreword to the standard states *"Response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day, and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood."*

3.2.1.2 The Scope of BS4142 includes the following guidance *"The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident".*

3.2.1.3 It should be noted that exclusions to the use of the standard is carefully defined as follows

- *"The determination of noise amounting to a nuisance is beyond the scope of this British Standard "and that the*
- *"Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems" also*
- *"The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels" and*
- *"The standard is not applicable to the assessment of low frequency noise"*

Therefore, the consideration of any of the above is outside the scope of this report.

3.2.1.4 The Scope of the standard goes on to state that:

"This standard is applicable to the determination of the following levels at outdoor locations:

- *Rating levels for sources of sound of an industrial and/or commercial nature; and*
- *Ambient, background, and residual levels*

For the purposes of:

- *Investigating complaints;*
- *Assessing sound from proposed, new, modified or additional sources(s) of sound of an industrial and/or commercial nature; and*
- *Assessing sound at a proposed new dwellings or premises used for residential purposes."*

3.2.1.5 The unit of measurement usually used for measuring environmental sound is the A weighted decibel (dB). The "A weighting" is an internationally agreed frequency response, generally similar to that of the human ear, so that measured sound levels correspond reasonably well with what is heard.

3.2.1.6 In most situations, sound levels vary continuously and it is customary to use a system of percentile values, which enable the noise climate to be described statistically. For example, the L_{A10} is the 'A-weighted' sound level exceeded for 10% of a given time period and in the case of road traffic, for which it is widely used, it provides an indication of typical maximum levels. The L_{A90}, being the sound level exceeded for 90% of the time, represents the typical minimum sound level in an area and is often referred to as the background sound level.

3.2.1.7 Sometimes it is convenient to give a single figure summarising all the sound received by equating it to the equivalent continuous sound level L_{Aeq} in dB, which would contain the same sound energy as the actual fluctuating sound levels.

3.2.1.8 Measurement locations are chosen that will give results that are representative of the ambient sound and residual sound at the assessment location(s). Specific,

ambient and background sound measurements are usually taken at a height of 1.2m to 1.5m above the ground and under similar conditions to the assessment location(s) and at least 3.5m from any other reflecting surface. Where this is not possible, calculated levels as per an accepted methodology e.g. BS 5288 or ISO 9613-2, can be used.

3.2.2 **Specific Sound Level**

3.2.2.1 The specific sound level in terms of L_{Aeq}, produced by the sound source under investigation, is determined at the assessment location(s) as a discrete entity, distinct and free of other influences contributing to the ambient sound.

3.2.2.2 The specific sound level is evaluated over an appropriate reference time interval, T_r defined in the standard as:

- 1 hour during the daytime period (07:00 – 23:00 hours)
- 15 minutes during the night time period (23:00 – 07:00 hours)

3.2.2.3 Where possible, the ambient sound level and the residual sound level are measured at the assessment location(s)

3.2.2.4 The ambient sound level comprises the specific sound plus the residual sound. The residual sound is all sounds near and far measured in the absence of the specific sound.

3.2.2.5 If the residual sound level is close to the ambient sound level, the ambient sound level is corrected to account for the effect of the residual sound on the specific sound level.

3.2.2.6 Where the ambient sound level and the measured residual sound level are within 10 dB of each other, then the specific sound level is corrected as follows

$$L_S = 10\lg\left(10^{\frac{L_a}{10}} - 10^{\frac{L_r}{10}}\right)$$

where:

L_s is the specific sound level;

L_a is the ambient sound level; and

L_r is the residual sound level.

3.2.2.7 As per the guidance in BS4142, *"Where it is not possible to determine the specific sound level by measurement of the ambient sound level and the residual sound level at the assessment location(s), for example, because the difference between the ambient sound level and the residual sound level is >3 dB, determine the specific sound level by a combination of measurement and calculation. Report the method of calculation in detail and give the reason for using it."*

3.2.2.8 If the specific sound is intermittent, and either steady or cyclic and the on-time of the source is less than the reference time interval then the specific sound level corrected for the effect of the residual level determined above is further corrected for the on-time using the correction term:

$$10 \lg \left(\frac{T_o}{T_r} \right)$$

where T_o is the on-time of the specific source

and T_r is the reference time period

3.2.3 **Background Sound Levels**

3.2.3.1 The background sound level is discussed in Clause 8.1 in BS4142 as follows *"The background sound level is an underlying level of sound over a period, T, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds".*

3.2.3.2 And *"…Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound."*

3.2.3.3 BS 4142 [1] gives guidance on the lowest limit to which the background sound level can be measured as follows "*Care is necessary in circumstances where background sound levels are low to ensure that self-generated and electrical noise within the measurement system does not unduly influence reported values, which might be the case if the measured background sound levels are less than 10 dB above the noise floor of the measuring system.".*

3.2.3.4 The meter used for the survey was a BK 2250 which has a specified internal noise floor of 16.6 dB which means that sound levels of equal to or greater than 16.6 +10 dB(A) = 27 dB would meet the above criteria.

3.2.3.5 In this case the minimum measured background sound level was 33 dB, so BS4142 methodology does apply

3.2.3.6 BS4142 provides extensive guidance on assessing the representative Background Sound Level advising that "In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."

3.2.4 **Rating Level**

3.2.4.1 Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background level.

3.2.4.2 If the source sound has a feature which makes it particularly noticeable, e.g., a tonal or impulsive characteristic, a character correction is added to the measured or calculated specific sound level to obtain the rating level in order to account for its more noticeable nature.

3.2.4.3 BS4142 specifies the following approaches for determining the character correction:

- Subjective method;
- Objective method for tonality;
- Reference method.

3.2.5 **Subjective method**

3.2.5.1 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.

3.2.5.2 BS4142 specifies the following penalties for tones:

- 2 dB for a tone which is just perceptible at the noise receptor
- 4 dB where it is clearly perceptible
- 6 dB where it is highly perceptible

3.2.5.3 BS4142 specifies the following penalties for impulsivity:

- 3 dB for impulsivity which is just perceptible at the noise receptor
- 6 dB where it is clearly perceptible
- 9 dB where it is highly perceptible

3.2.5.4 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.

3.2.5.5 Where the specific sound is intermittent and has identifiable on/off conditions that are "*readily distinctive against the residual acoustic environment*", a penalty of 3 dB can be applied.

3.2.5.6 BS4142 further explains that "…*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."*

3.2.5.7 The maximum character corrections that could be applied to the specific sound level would be 18 dB for a specific sound that has both highly perceptible tonal and impulsive characteristics with identifiable on/off conditions.

3.2.6 **Objective method for tonality**

3.2.6.1 Where the subjective method is not sufficient to assess the tones or impulsive sounds then BS4142 recommends the following *"If the subjective method is not sufficient for assessing the audibility of tones in sound or the prominence of impulsive sounds, use the one-third octave method…and/or the reference methods…as appropriate".*

BS4142 specifies a method for identifying tones in Annex C of the standard, and a correction of 6 dB is added if a tone is present.

3.2.7 **Reference method**

3.2.7.1 If the one third octave method is not sufficient BS4142 specifies the use of the Reference method contained in Annex D for the audibility of tones and Annex E for the prominence of impulsive sounds. This method produces a penalty on a sliding scale of 0.0 dB to 6.0 dB for tones and 0.0 dB to 9.0 dB for impulsive sounds.

Guidance as to the application of the penalties is given is given as follows "*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".*

3.3 **Uncertainty**

3.3.1 There is a requirement in BS4142 to consider the level of uncertainty in the data and associated calculations.

3.4 **Significance of impact**

3.4.1 The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

3.4.2 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level and using the

magnitude of this difference to assess the significance of impact as summarised in Table 1 below. Typically, the greater this difference, the greater the magnitude of the impact.

Table 1– BS 4142 Impact Significance Criteria

Rating Level minus Background Sound Level	BS 4142 Significance of Impact
+10 dB	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
+5 dB	A difference of around +5 dB or more is likely to be an indication of an adverse impact, depending on the context
≤ 0 dB	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 context.

3.4.3 Adverse impacts include, but are not limited to, annoyance and sleep disturbance.

3.4.4 It should be noted that not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

3.5 BS 8233 - Guidance on Sound Insulation and Noise Reduction for Buildings [2]

3.5.1 For many common situations, BS 8233 [2] suggests criteria, such as suitable sleeping/resting conditions, and proposes noise levels that normally satisfy these criteria for most people.

3.5.2 The foreword advises that the information detailed in BS 8233 [2] "*…takes the form of guidance and recommendations. It should not be quoted as it were a specification or a code of practice and claims of compliance cannot be made to it.".*

3.5.3 Section 7.7.2 details the guideline values for desirable internal ambient noise levels within dwelling houses, flats and in residential use (when unoccupied) when such properties are exposed to steady external noise sources.

3.5.4 These guideline values range from 35 - 40 dB $L_{Aeq,16hrs}$ during the daytime period and 30 dB $L_{Aeq,8hrs}$ during the night time period.

3.5.5 The guidelines also provide scope for relaxing these values by up to 5 dB and still achieve reasonable internal conditions.

3.5.6 The internal noise level in a room is calculated by subtracting the sound reduction performance of the external façade from the noise level outside the room. The glazing in the façade is assumed to be in the closed position for these calculations.

4.0 ASSESSMENT OF IMPACTS

4.1 Assessment of Plant Noise as per BS4142 [1]

4.1.1 Proposed Plant

4.1.2 At the time of this assessment, confirmed details of the proposed plant associated with the commercial development are unknown. At this stage, it is proposed to utilise plant that will be similar to 'Optyma Plus New Generation' from Danfoss.

4.1.3 The plant will comprise three condenser units. Each unit will serve the freezers, the Butchers coldroom and the multideck cabinets respectively.

4.1.4 Manufacturers data for noise emissions were provided by the client to use in the assessment calculations (see Appendix 3).

4.1.5 It is proposed to locate the plant on the roof of the refurbished supermarket at the centre of the boundary between the supermarket and flats.

4.1.6 Nearest Sound Sensitive Receptors

4.1.7 There are no proposed outdoor amenity areas for the residential development. Therefore, the nearest receptors are assumed to be within the new flats in the converted office building, at the rear of the site.

4.1.8 With reference to the proposed development plans in Appendix 3, these rooms are identified as the bedrooms of flats 1 and 5. The windows to these rooms are approximately 10m from the proposed location of the plant.

4.1.9 Reference Time Interval

4.1.10 The proposed plant is to operate 24/7 and therefore this assessment considers that the night time period when the residual sound is at its lowest when any impact is at its greatest.

4.1.11 The reference time interval for the night time period is 15 minutes. It is assumed that the plant will be operating continuously throughout the reference time period.

4.1.12 **Specific Sound Level**

4.1.13 In this case, the plant is not yet operational so the specific sound level was calculated.

4.1.14 The manufacturers' data details the sound emission levels for a range of condenser units. To represent the maximum potential impact this assessment has assumed that the model used is the unit with the maximum sound emission levels.

4.1.15 With reference to the manufacturers' data in Appendix 3, the data for the model 'OP-LPHM215' is used in the calculations.

4.1.16 The data indicates that this condenser unit has a sound power level of 78 dBA.

4.1.17 The assessment assumes that all three condenser units run in a coherent manner and the total sound emission level from the plant is the energy summation of the three individual units. This results in a total sound power level of 78 + 78 + 78 = 83 dBA.

4.1.18 The nearest sound sensitive property is located approximately 10m from the proposed plant and the sound propagation loss due to distance can be calculated using the formula:

$$L_{Aeq,t} = L_{wA} - 20\text{Log}(r) - 8 \text{ dBA}$$

4.1.19 As the proposed plant is installed onto the roof, the above formula assumes that the sound propagates hemi-spherically as a point source.

4.1.20 Substituting the values for the sound power level and propagation distance into the formula, the specific sound level outside the nearest sensitive receptor is calculated as $L_{Aeq,t} = 83 - 20\text{Log}(10) - 8 = 55$ dBA.

4.1.21 The nearest receptor does not have a direct line of site to the sound source and so a further correction of -10 dB is applied to the calculated specific sound level to account for the barrier effect of the building.

4.1.22 This results in a specific sound level of $L_{Aeq,t} = 55 - 10 = 45$ dBA.

4.1.23 It is assumed that the plant operates continuously throughout the t = 15 minute reference time period and no correction is made for the on time.

4.1.24 As the plant is not yet operational, the specific sound level has been calculated and therefore it is not necessary to correct this level for the influence of residual sound.

4.1.25 In this case, the specific sound level, when assessed at the nearest sensitive receptor, is calculated as 45 dB $L_{Aeq,15mins}$.

4.2 **Background Sound Level**

4.2.1 The background sound level was measured at the assessment location throughout an 8-hour night time period. The survey data is presented in Appendix 4.

4.2.2 Inspection of the data reveals that during the period 02:25 – 05:50 hours, the ambient noise level was raised significantly for reasons unknown.

4.2.3 The data collected during this period was deemed unrepresentative of the background sound at the receptor and was excluded from the calculations.

4.2.4 The remaining data was analysed using B&K Evaluator software to determine the background sound level which is deemed more representative of the acoustic climate at the development site.

4.2.5 The representative background sound level was determined to be 36 dB $L_{A90,4\ hrs,35\ minutes}$.

4.2.6 The background noise was assessed over a longer period than the 15 minute reference time period to reflect the varying ambient sound levels typical for an urban environment.

4.3 **Rating Level**

4.3.1 The nearest receptors are located within the bedrooms of proposed flats 1 and 5. An assessment of the acoustic climate at the site (detailed in paragraph 4.7), indicates that sound insulation measures are required for these rooms and to control the internal noise levels, the windows will be closed.

4.3.2 For the receptor located within the bedroom with the window closed, it is reasonable to assume that there will be no distinct acoustic features at this location.

4.3.3 No acoustic feature correction is applied to the calculated specific sound level.

4.3.4 The rating level is assigned the value of the specific sound level which is equal to 45 dB.

4.4 **Uncertainty**

4.4.1 There is a level of uncertainty associated with the data and associated calculations.

4.4.2 The effect of this uncertainty has been reduced by adopting a worst-case approach where possible.

4.4.3 The condenser units chosen to be assessed have the highest sound power level stated by the manufacturer so as to calculate the maximum impact.

4.4.4 It is assumed that the units operate in a coherent manner and all operate simultaneously and continuously. In reality, this is unlikely and the impact will be lower than assessed.

4.4.5 To reflect the variability in the acoustic environment in an urban environment, the background sound level has been assessed over a longer period of 4 hours and 35 minutes.

4.4.6 Extraneous noise identified from the data has been excluded from the calculations to better represent the acoustic climate.

4.4.7 Due to the relatively short propagation distances, changes in meteorological conditions will not have a significant effect on the propagation calculations and were not considered.

4.5 **Significance of Impact**

4.5.1 An initial estimate of the impact of the proposed plant is obtained by subtracting the measured background sound level from the rating level.

4.5.2 In this case, the difference between the rating level and the measured background sound level is 45 – 36 = +9 dB.

4.5.3 BS4142 states that '*A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*'

4.6 **Context**

4.6.1 The context in this case is the introduction of a new item of plant into an urban mixed commercial/residential environment. The data from the survey indicates that the residual sound level is regularly at or above the level of the plant.

4.6.2 Furthermore, the sensitive receptor is indoors with the windows closed to secure good internal acoustic conditions as described in the next section.

4.6.3 Calculations in Appendix 5 indicate that the sound reduction from outside to inside is 31 dB $R_w + C_{tr}$ for a typical façade with the window in the closed position.

4.6.4 Therefore, the sound level from the plant will be significantly lower inside the dwelling where residual sound within the dwelling will mask the sound from the plant.

4.6.5 Taking the context into consideration, the initial estimate of the impact should be modified to reflect the above.

4.6.6 For the receptor inside the bedroom with the window closed, the maximum impact from the plant with the highest sound power levels will be low following consideration of the context.

4.7 Assessment of Internal Noise Levels as per BS8233 [2]

4.7.1 Noise levels were measured at the most exposed façade of the proposed residential development.

4.7.2 It is assumed that the external noise level represents the level of noise outside all habitable rooms, with a view of either the car park or Commercial Road.

4.7.3 The measured levels are summarised in Table 2 below:

Table 2 – Summary of External Noise Levels

Period, t	Measured Façade Level $L_{Aeq,t}$ (dBdB)
Daytime (07:00 – 23:00)	57
Night-time (23:00 - 07:	51

4.8 Open Window Ventilation Strategy

4.8.1 Whenever possible, it is desirable to open the windows to provide ventilation and when partially open windows are relied upon for background ventilation, the sound reduction of the façade is reduced to 15 dB [2].

4.8.2 Applying this reduction to the measured external noise levels detailed in Table 2, the internal noise level within the rooms, at the most exposed façades will be 57 – 15 = 42 dB $L_{Aeq,16hrs}$ during the daytime, and 51 – 15 = 36 dB $L_{Aeq,8hrs}$ during the night-time. These calculated internal noise levels exceed the guideline criteria for indoor ambient noise levels for dwellings as detailed in BS 8233 [2].

4.8.3 To represent the worst case, the calculated internal noise levels, with an open window, should be applied to all habitable rooms with a view of either the car park, Commercial Road or both.

4.8.4 The affected rooms are the bedrooms of Flats 1 and 5, and the lounge/dining /kitchen of Flats 6 and 8.

4.8.5 All other habitable rooms, within the development are acoustically screened from the significant noise sources by the building itself, and the external noise levels will be a minimum of 10 dB below the measured value, due to the barrier effect.

4.8.6 For these rooms the internal noise level is calculated as 57 – 10 – 15 = 32 dB $L_{Aeq,16hrs}$ during the daytime, and 51 – 10 -15 = 26 dB $L_{Aeq,8hrs}$ during the night-time.

4.8.7 The calculated internal noise levels, for habitable rooms at the rear of the building, satisfy the guideline criteria for indoor ambient noise levels for dwellings as detailed in BS 8233 [2] and no additional mitigation is required.

4.9 Sound Insulation Measures

4.9.1 Sound insulation measure are required to control the internal noise level, within the affected rooms, identified in the previous section.

4.9.2 It is recommended that these measures comprise the use of standard thermal 4/20/4 glazing in the closed position.

4.9.3 Calculations in Appendix 5 indicate that the sound reduction for a typical brick façade with a closed 4/20/4 glazing unit is 31 R_W + Ctr.

4.9.4 Applying this reduction to the measured external noise levels detailed in Table 2, the internal noise level within the affected rooms will be 57 – 31 = 26 dB $L_{Aeq,16hrs}$ during the daytime and 51 – 31 = 20 dB $L_{Aeq,8hrs}$ during the night-time.

4.9.5 These levels satisfy the guideline criteria for internal ambient noise levels for dwellings as detailed in BS 8233 [2], and clearly demonstrate that the use of standard thermal 4/20/4 glazing in the closed position is effective in controlling the internal noise to acceptable levels. Note that there is no requirement for these windows to be permanently closed.

4.9.6 For all rooms where sound insulation measures are recommended, an alternative means of ventilation may be required.

4.9.7 It is important that any scheme of ventilation does not compromise the façade sound insulation, or the resultant internal noise levels and any such scheme should be approved by Building Control.

5.0 CONCLUSIONS

5.1 The proposed development is for mixed residential/commercial use.

5.2 Newport City Council provided the following scoping opinion:
"any residential proposal for 170 -172 Commercial Road will require a BS 4142:2014 assessment and BS 8233 noise report"

5.3 The residential component of the development comprises 8 flats located at the rear of the development site.

5.4 The results of this assessment indicate that using a partially open window to provide background ventilation, the predicted internal noise levels within the bedrooms of Flats 1 and 5, and within the lounge/dining/kitchen of Flats 6 and 8, will exceed the guidelines values detailed in BS 8233 [2].

5.5 To achieve the guideline internal ambient noise levels within these rooms, sound insulation measures are required.

5.6 The guideline values for internal ambient noise levels as detailed in BS 8233 [2] can be achieved within the remaining habitable rooms using a partially open window to provide background ventilation.

5.7 Confirmed details of any proposed plant associated with the commercial development are unavailable.

5.8 In the absence of these plant details, an assessment of potential impact was been completed using data from a range of suitable plant.

5.9 The sensitive receptor is located within the bedroom of flats 1 or 5 and, as identified above, the windows are in the closed position to control the noise ingress.

5.10 This report concludes that, following consideration of the context of the proposed plant installation, the impact at the sensitive receptor within the bedrooms of flats 1 and 5 will be low.

7.0 RECOMMENDATIONS

7.1 It is recommended that sound insulation measures are provided for the bedrooms of Flats 1 and 5, and for the lounge/dining/kitchen of Flats 6 and 8 comprising standard thermal 4/20/4 glazing, in the closed position.

7.2 Note that there is no requirement for these windows to be permanently closed.

7.3 For all rooms where sound insulation measures are recommended, an alternative means of ventilation may be required.

7.4 It is important that any scheme of ventilation does not compromise the façade sound insulation, or the resultant internal noise levels.

7.5 Any such scheme should be approved by Building Control.

P.A.T. 13/01/17
M.Sc., I.Eng., M.I.O.A., M.Inst.SCE., M.A.E.S.

Appendix 1
Baseline Survey Details

A1.0 BASELINE SURVEY DETAILS

A1.1 **Programme of Measurements**

A1.1.1 Measurements were carried out on 5th December 2016. The survey commenced at 11:25 hours for a total survey period of 24 hours.

A1.1.2 The meter was calibrated at the start of the measurement procedure and checked after each set of measurements. No significant deviation i.e. > 0.5 dB was recorded.

A1.1.3 The meter was located in a weather-proof container and powered with the heavy duty rechargeable batteries. The microphone was located on a bracket extending approximately 1m from the front façade of the existing building at a height of approximately 4.5m. The microphone was inside an approved weather-proof microphone housing.

A1.1.4 This location was chosen to represent the most exposed location within the proposed development and enjoyed an uninterrupted view of the road traffic travelling along Commercial Road and Francis Road and overlooked the adjacent car park.

A1.1.5 The meter was adjusted to measure L_{AF90} and L_{Afeq} and set to log and store in 5 minute samples throughout the survey period.

A1.1.6 The effect of passing traffic and general environmental noise was included in this measurement.

A1.1.7 At appropriate periods the data was down-loaded to a computer for further analysis.

A1.1.8 The analysis consisted of using B&K 7820 Evaluator software to divide the results into the time periods 07:00-23:00 and 23:00-07:00.

A1.1.9 The data is further analysed to determine a representative value for the background noise using statistical methods to determine the median value for each of the daytime and night time periods. The data is presented in the results section.

A1.1.10 Weather conditions: 100% cloud cover, cool, damp, slight intermittent breeze.

A1.2 Subjective impressions

A1.2.1 The acoustic environment during the survey was dominated by road traffic with lesser contributions from human activity

A1.2.2 The equipment was monitored by a guard who made notes on any extraneous noise events and weather conditions.

A1.3 Guard Observations

Table 3 – Guard Observations

Time	Subjective Comment
12:30	Regular cars moving in and out of car park
13:43	Car playing loud music
16:28	Still lots of traffic on commercial road
17:00	Loud car outside shop front
18:00	Someone banging bins on main st
18:20	Loud banging from building did a sweep nothing to report
19:20	Car under microphone
19:23	Car leaving from under mic
19:30	Large crowd around microphone
00:17	Loud music from next street
00:20	Doors and people kicking bins around
01:50	Loud music
02:35	3 men watching guards and front door full patrol to make presence felt
03:50	3 men jumping on the wall next to the property when asked told they were going in the building
06:10	Commercial road getting busy
08:10	Roads busy car park starting to fill up
09:30	Loads of shouting

A1.3.1 The security guard was instructed to keep a log of any unusual noises or activities and to provide subjective comments of the noise climate during the survey. These observations are detailed in Table 3 above.

A1.4 Equipment Used

Table 4– Equipment Used

ITEM	Serial No	UKAS Calibration Certificate Date (if applicable)
(ANL-M3) B&K 2250 Handheld Analyser	2559188	Certificate: 14992 Date: 18/05/16
(ANL-C3) B&K 4230 Calibrator	260937	Certificate: 14991 Date: 18/05/16

Appendix 2
View of Measurement Position

A2.0 VIEW OF MEASUREMENT POSITION

Figure 1 – Satellite View of Measurement Position

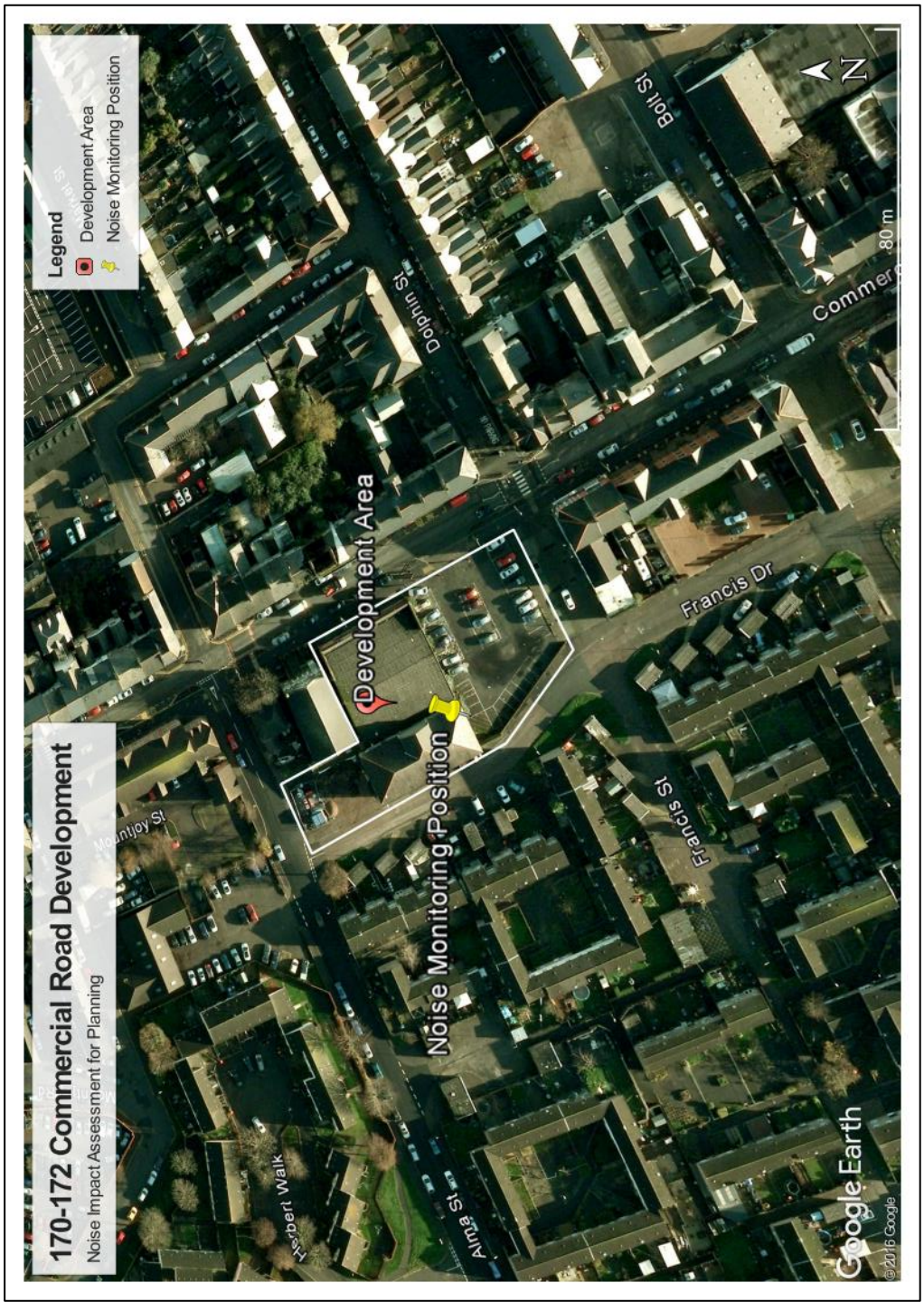

Figure 2 – Image of Microphone Position

Appendix 3
Proposed Development Drawings and Manufacturers' Data

A3.0 PROPOSED DEVELOPMENT DRAWINGS

Figure 3 – Plan of Proposed Development

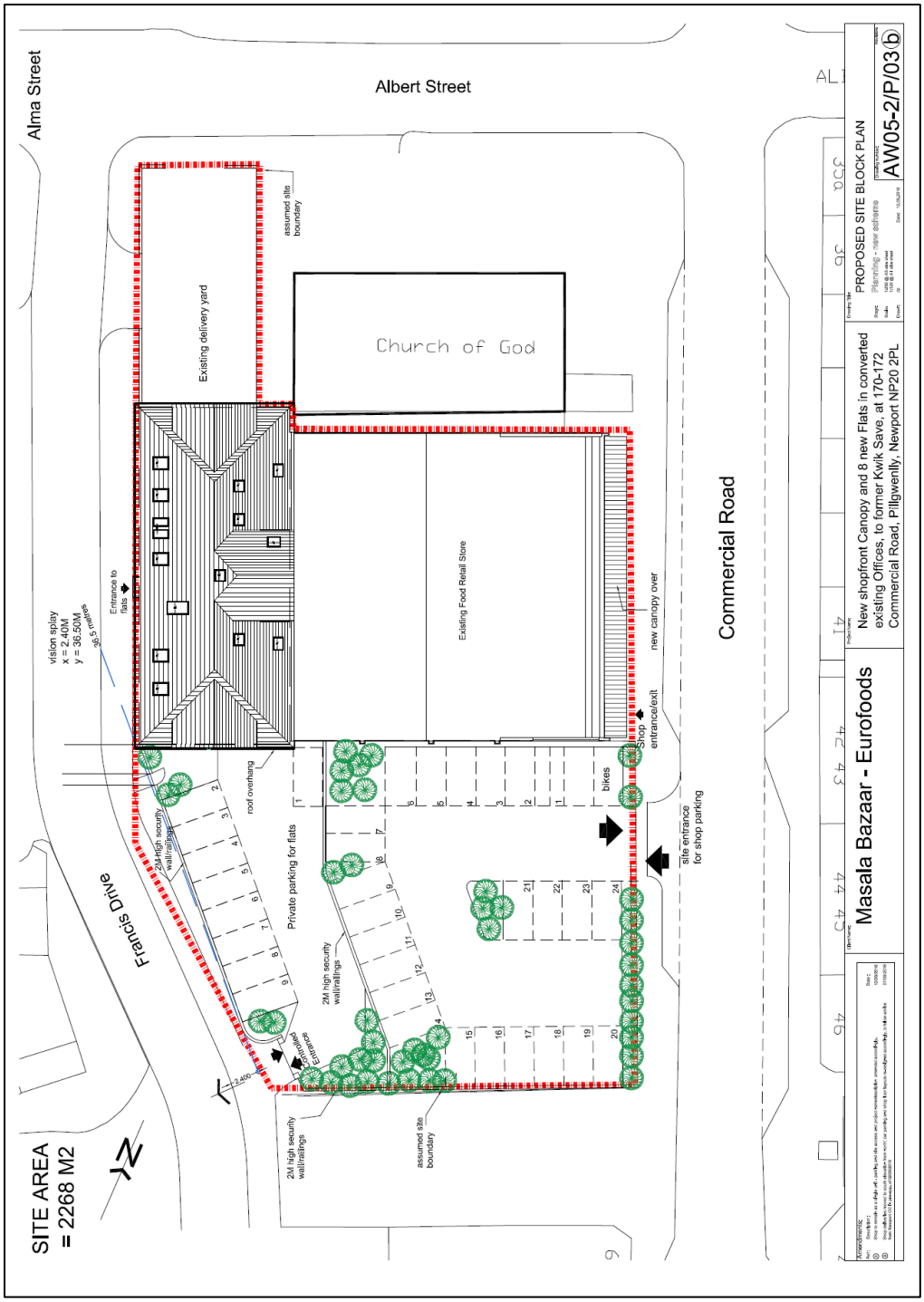

Figure 4 – Proposed Layout of Flats

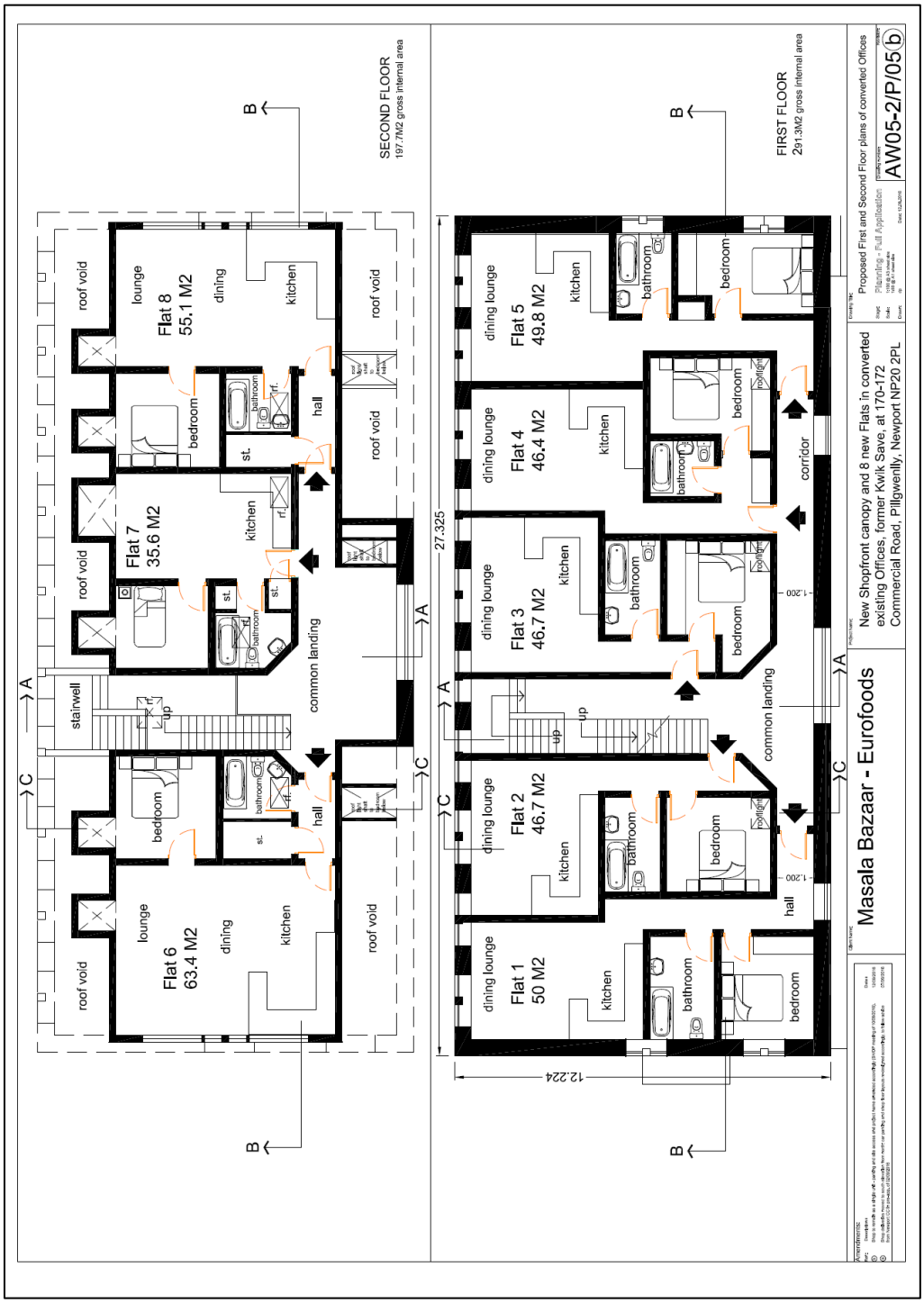

Figure 5 – Manufacturers' Data for Anticipated Plant

Danfoss

Catalogue **R404A/R507 LBP**

Fan	Test conditions	Unit	Code	Electrical code	Compressor	Amb. temp. °C	Cooling capacity range in (W) at evaporating temperature (°C) -40°C	-35°C	-30°C	-25°C	-20°C	-15°C	-10°C	Sound power level dB(A)	Sound pressure level full sphere 10m dB(A)
		OP-LPHM018	114X3109	G	SC18CLX.2	27	370	500	650	830	1030	1270	1540	60	29
						32	320	440	580	750	940	1160	1410		
						38	270	370	500	650	820	1030	1260		
						43	220	310	430	570	730	910	1120		
		OP-LPHM026	114X3216	G	CAJ2446Z	27	500	700	1000	1250	1600	2000	2450	67	36
						32	450	650	850	1150	1450	1800	2200		
						38		550	750	1000	1250	1600	1950		
						43		450	650	850	1100	1400	1750		
		OP-LPHM048	114X3225	G	NTZ048	27	750	1150	1550	2050	2650	3300	4000	69	38
						32	650	1000	1400	1850	2350	2950	3600		
			114X3233	E		38	550	850	1200	1600	2050	2550	3150		
						43	450	700	1000	1350	1750				
		OP-LPHM074	114X3252	G	FH2511Z	27	1200	1650	2250	2950	3700	4550	5450	69	38
						32	1000	1450	1950	2600	3300	4050	4950		
			114X3253	E	TFH2511Z	38		1150	1650	2200	2800	3550	4300		
						43		950	1400	1900	2450	3100	3800		
	SH 10K	OP-LPHM068	114X3241	G	NTZ068	27	1350	1850	2450	3100	3850	4650	5550	70	39
						32	1150	1650	2150	2750	3450	4200	5050		
			114X3249	E		38	950	1350	1850	2400	3000	3650	4400		
						43	800	1200	1600	2100	2600				
		OP-LPHM096	114X3357	E	NTZ096	27	1650	2350	3150	4200	5400	6850	8500	72	41
						32	1450	2050	2800	3750	4900	6200	7750		
						38	1150	1700	2350	3200	4250	5450	6850		
						43	900	1400	2000	2750	3650				
		OP-LPHM136	114X3365	E	NTZ136	27	2550	3500	4650	5950	7500	9250	11200	73	42
						32	2250	3100	4100	5350	6750	8400	10200		
						38	1850	2600	3550	4600	5900	7350	8950		
						43	1500	2200	3050	4000	5150				
		OP-LPHM215	114X3476	E	LLZ024	27	4000	5100	6450	8000	9850	11950	14300	78	47
						32	3700	4700	5950	7400	9100	11000	13200		
						38	3300	4250	5350	6600	8150	9850	11850		
						43	2950	3800	4800	5950	7300	8850	10650		
		OP-LPHM271	114X3482	E	LLZ034	27	5500	6900	8550	10550	12800	15350	18200	78	47
						32	5000	6300	7850	9650	11700	14050	16650		
						38	4400	5600	6950	8550	10350	12450	14750		
						43	3850	4900	6150	7600	9200	11050	13100		

Test condition
Superheat 10K
Subcooling 0K

Electrical code
E - Compressor 400V/3phase/50Hz, fan 230V/1phase/50 Hz
G - Compressor 230V/1phase/50Hz, fan 230V/1phase/50 Hz

LLZ type compressor models are scroll compressors

Units can operate down to -45 evaporating temperature. Refer to dedicated Software or contact Danfoss for more details

Cooling capacity is given for units with 3-phase compressor. Capacity of single-phase versions is within +/- 1% of this value

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Appendix 4
Survey Results

A4.0 SURVEY RESULTS

Table 5– Meter Details

Instrument:		2250
Application:		BZ7224 Version 4.6.3
Start Time:		12/05/2016 11:25:10
End Time:		12/06/2016 11:31:19
Elapsed Time:		1.00:06:09
Bandwidth:		Broadband
Max Input Level:		140.65
	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		A
Instrument Serial Number:		2559188
Microphone Serial Number:		2556132
Input:		Top Socket
Windscreen Correction:		None
Sound Field Correction:		Free-field
Calibration Time:		12/05/2016 11:18:42
Calibration Type:		External reference
Sensitivity:		51.7541281878948 mV/Pa

Table 6 – External Façade Noise Levels (Day Time Profile)

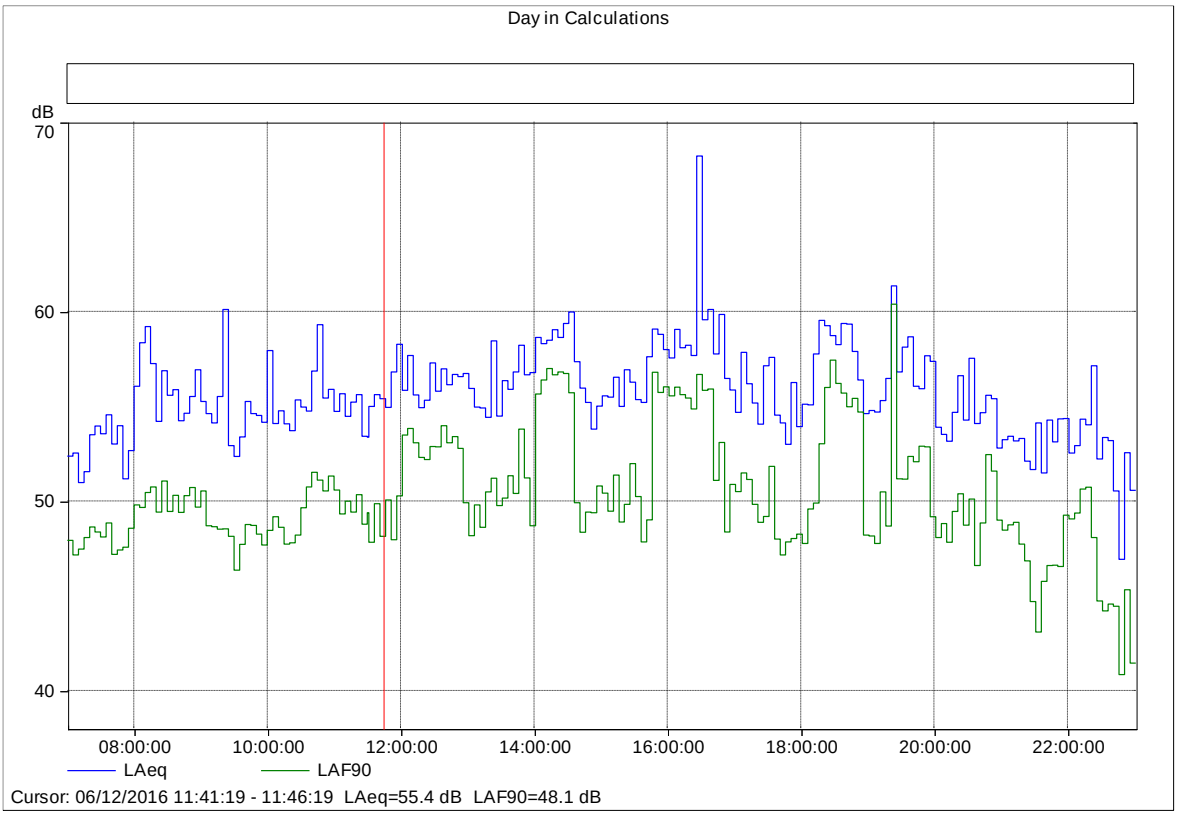

Table 7 – External Façade Noise Levels (Day Time Summary)

Name	Start time	Overload [%]	Duration, t	$L_{Aeq,\ t}$ [dB]	$L_{AF90,\ t}$ [dB]
Total	06/12/2016 07:00:00	0.0	16:00:00	56.5	48.8
Unmarked	06/12/2016 07:00:00	0.0	16:00:00	56.5	48.8

Figure 6 – External Façade Noise Levels (Night Time Profile)

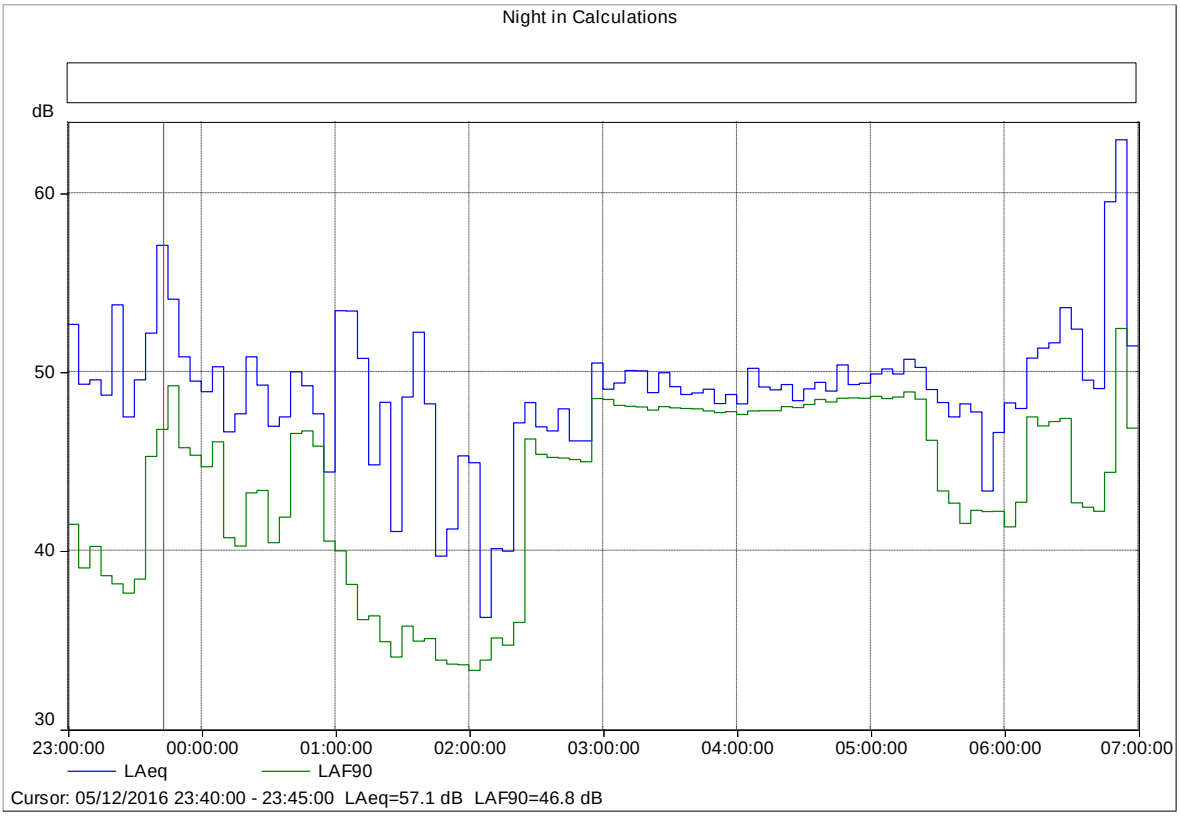

Table 8 – External Façade Noise Levels (Night Time Summary)

Name	Start time	Overload [%]	Duration, t	$L_{Aeq,\,t}$ [dB]	$L_{AF90,\,t}$ [dB]
Total	05/12/2016 23:00:00	0.0	8:00:00	50.7	38.2
Unmarked	05/12/2016 23:00:00	0.0	8:00:00	50.7	38.2

Figure 7 – Representative Night Time Background Sound Level Analysis

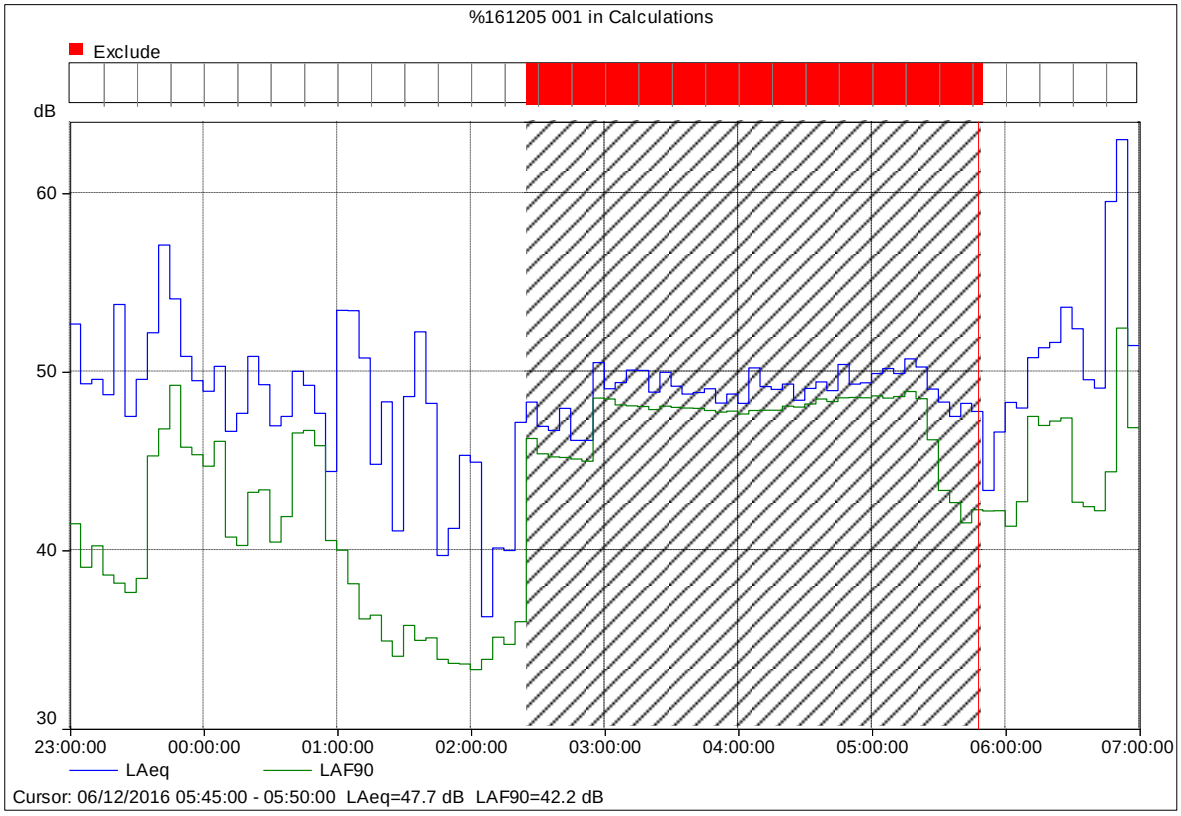

Table 9 – Representative Night Time Background Sound Level (Night Time Summary)

Name	Start time	Overload [%]	Duration, t	$L_{AF90,t}$ [dB]
Total	05/12/2016 23:00:00	0.0	4:35:00	36.1
Exclude	06/12/2016 02:25:00	0.0	3:25:00	45.6
Unmarked	05/12/2016 23:00:00	0.0	4:35:00	36.1

Appendix 5
Internal Sound Level Calculations

A5.0 INTERNAL SOUND LEVEL CALCULATIONS

A5.1 **Building Envelope**

A5.1.1 The following calculations apply the procedures detailed in 'Sound Control for Homes' [3].

A5.1.2 These procedures require the following information for accurate calculation of the sound insulation requirements of the building envelope:

External noise level.
Maximum allowable sound level in the room.
Surface area of the relevant portion of the building envelope.
Area of sound absorption in the room.

A5.1.3 The following formula is used to determine the façade sound insulation against road traffic noise:

Level Difference = $L_1 - L_2 = R - 10 \log (S/A)$

Where L_1 *- Sound level 2m outside the façade (dB)*
L_2 *- Received sound level in the room (dB)*
R - Sound reduction index (dB)
S - Surface area, room façade element (m^2)
A - Absorption in the room (m^2)

A5.1.4 For housing design purposes a more simple approach is proposed by 'Sound Control for Homes':

The surface area and area of sound absorption can be ignored. In typically furnished domestic rooms they have little effect on the final result.

A typical external noise spectrum is adopted and the sound insulation of the building envelope described in terms of the difference between inside and outside levels in dB(A).

A5.1.5 This outside-inside level difference, denoted by $R_{A(traffic)}$, is based on the typical urban road traffic noise spectrum.

A5.1.6 This term can also be represented by $R_w + C_{tr}$ where R_w is the weighted sound reduction index and C_{tr} is the correction against low frequency performance and is based on urban road traffic noise or railway traffic at low speed as stated in BS EN ISO 717-1 [4].

A5.1.7 In this case the significant source of noise is road traffic along Commercial Road and will be travelling at low speeds.

A5.1.8 Calculations are made for the most exposed façades within the development. These will be the façades that face the road/car park track directly.

A5.1.9 If we assume that the glazing area is 30% of the total internal wall area for a typical habitable room then using the chart in Figure 49 presented in 'Sound control for homes' [3] we can calculate the composite sound insulation for the façade by adding a correction factor to the sound reduction for the glazing.

A5.1.10 Composite façade sound reduction calculations are shown in Table 10 below.

Table 10 – Composite façade sound reduction

Description	Term	Value	Comment
Total Glazing Area as percentage of Wall Area	%	30	Assumption for typical room
Walls, R_{wall}	$R_{A(Traffic)}$	47	Sound Control for Homes, Table 14, Cavity brick/block
Glazing, R_{window}	$R_w + C_{tr}$	26	Saint Gobain Acoustic Database, 4/20/4
R_{wall} - R_{window}		21	
Add to R_{window}		5	from Figure 49
Composite Façade	$R_w + C_{tr}$	31	

A5.2 Internal Sound Level Calculations

A5.3 Using the calculated composite façade sound reduction and the results from the 24-hour survey for façade levels we have predicted the internal sound levels inside the rooms as detailed in Table 11.

Table 11– Internal Noise Levels, Habitable Rooms facing Sound Source

Description	Daytime Façade Level $L_{Aeq,16hrs}$ (dB)	Night Time Façade Level $L_{Aeq,8hrs}$ (dB)
Habitable Room	57	51
Composite Sound Reduction	31	31
Internal Noise Level	26	20

The above calculations assume that the glazing is 4mm glass/20mm air gap/4mm glass and that they are in the closed position.

Appendix 6
Glossary of Acoustic Terms

A6.0 GLOSSARY OF ACOUSTIC TERMS

A6.1 Acoustic Environment:

Sound from all sound sources as modified by the environment.

A6.2 Ambient Sound:

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.

NOTE: The ambient sound comprises the residual sound and the specific sound when present.

A6.3 Ambient Sound Level, $L_a = L_{Aeq,T}$:

Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the measurement location over a given time interval, T.

NOTE: The ambient sound level is a measure of the residual sound and the specific sound when present.

A6.4 A-Weighting:

Normal hearing covers the frequency (pitch) range from about 20 Hz to 20,000 Hz but sensitivity is greatest between about 500 Hz and 5,000 Hz. The 'A-weighting' is an electrical circuit built into noise meters to approximate this characteristic of human hearing.

A6.5 Background Sound Level, $L_{A90,T}$:

A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

A6.6 Decibel (dB):

The logarithmic measure of sound level. 0dB (A) is the threshold of normal hearing. 140 dB (A) is the level at which instantaneous damage to hearing is caused. A change of 1 dB is detectible only under laboratory conditions.

A6.7 dB(A):

Decibels measured on a sound level meter incorporating a frequency weighting (A-weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with an individual's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions and a change of 10 dB(A) corresponds roughly to doubling or halving the loudness of a sound.

A6.8 Equivalent Continuous A-weighted Sound Pressure Level, $L_{Aeq,T}$

Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t_1}^{t_2}\left[\frac{p_A(t)^2}{{p_0}^2}\right]dt\right\}$$

where

p_0 is the reference sound pressure (20 µPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure at time t

NOTE: the equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

A6.9 Free Field:

A sound field in which no significant sound reflections occur

A6.10 Frequency:

The number of cycles per second of a vibration usually expressed in units of Hertz, Hz

A6.11 Hertz:

Unit of frequency, equal to one cycle per second. Frequency determines the pitch of a sound.

A6.12 $L_{A10,T}$:

The 'A-weighted' noise level exceeded for 10% of the specified measurement period (T). It gives an indication of the upper limit of fluctuating noise such as that from

road traffic. $L_{A10,18hr}$ is the arithmetic average of the 18 hourly $L_{A10,1hr}$ values from 06:00 - 24:00.

A6.13 L_{Amax}:

The maximum 'A-weighted' level of noise recorded during a noise event. The time weighting used (Fast or Slow) should be stated.

A6.14 Measurement Time Interval, T_m:

Total time over which measurements are taken.

NOTE: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.

A6.15 Rating Level, $L_{Ar,Tr}$:

Specific sound level plus any adjustment for the characteristic features of the sound.

A6.16 Reference Time Interval, T_r:

Specified interval over which the specific sound level is determined.

NOTE: This is 1h during the day from 07:00 h to 23:00 h and a shorter period of 15min at night from 23:00 h to 07:00 h.

A6.17 Residual Sound:

Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

A6.18 Residual Sound Level, $L_r = L_{Aeq,T}$:

Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.

A6.19 Specific Sound Level, $L_s = L_{Aeq,T}$:

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

A6.20 Specific Sound Source:

Sound source being assessed.

A6.21 Tonality:

The degree to which a noise contains audible pure tones. Broadband noise (across a wider range of frequencies) is generally less annoying than noise with identifiable tones.

Appendix 7
References

A7.0 REFERENCES

1 BS 4142 : 2014 - " Methods for rating and assessing industrial and commercial sound", British Standards

2 BS 8233:2014. 'Guidance on sound insulation and noise reduction for buildings', British Standards Institution 2014

3 "Sound Control for Homes", Building Research Establishment and Construction Industry Research and Information Association, 1993

4 BS EN ISO 717-1:1997, 'Acoustics - Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation', British Standards