NOISE ASSESSMENT

The Pride of the Moorlands
Junction Road, Leek, Staffordshire
ST13 5QP

Report by
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Site Visited: 25th and 27th October 2017
Site Visited by: S.B. Mellor
Signed:



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1.0 INTRODUCTION

At the request of Adam Gregory of Forefront Development Consulting, on behalf of their client Mr. J. Barlow, SBM Safety Solutions Ltd undertook a noise assessment in connection with the proposed development of land where the former public house The Pride of the Moorlands is situated - Junction Road, Leek, ST13 5QP (7 x plots for domestic dwellings – see figure 1).

Outline planning permission has previously been granted for this site. This assessment and report made to meet condition 9 (see below) following approval – **Ref PC (SMD)/2016/0334**.

9. Development shall not commence until a site specific Noise Assessment and a Scheme for protecting the proposed residential units from external noise has been submitted to, and approved in writing by the Local Planning Authority. The submitted Scheme shall have due regard to the British Standard 8233:2014 (Sound insulation and noise reduction for buildings), and be designed to achieve noise levels of less than 35 dB LAeq in bedrooms, less than 40 dBLAeq in living areas and less than 55 dB Laeq in outdoor living areas. The development shall subsequently be carried out in accordance with the approved Scheme Pre completion tests shall be carried out to verify compliance with this condition and a report containing all raw data and showing how calculations have been made shall be submitted to the Local Planning Authority for its written approval before any of the units hereby approved are occupied.
Reason: To protect occupiers from noise and safeguard their residential amenities.

An original assessment was made in 2017 for a client of Forefront. Since then the site has been purchased by another client of theirs – this report reflects the additional requirements made by Staffordshire Moorlands District Council regarding an acoustic barrier and further details regarding mitigation to achieve internal noise levels – *Denis Colgan (Pollution Officer (Specialist)*.

Transportation (road noise) and other sources of noise (industry to the rear) would be examined where they could affect future residents of this development.

This report considers measurements made on site, the requirements of *NPPF National Planning Policy Framework* and refers to *ProPG Professional Practice Guidance on Planning & Noise* and current standards such as *BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings*, plus other appropriate criteria; and makes recommendations as necessary.

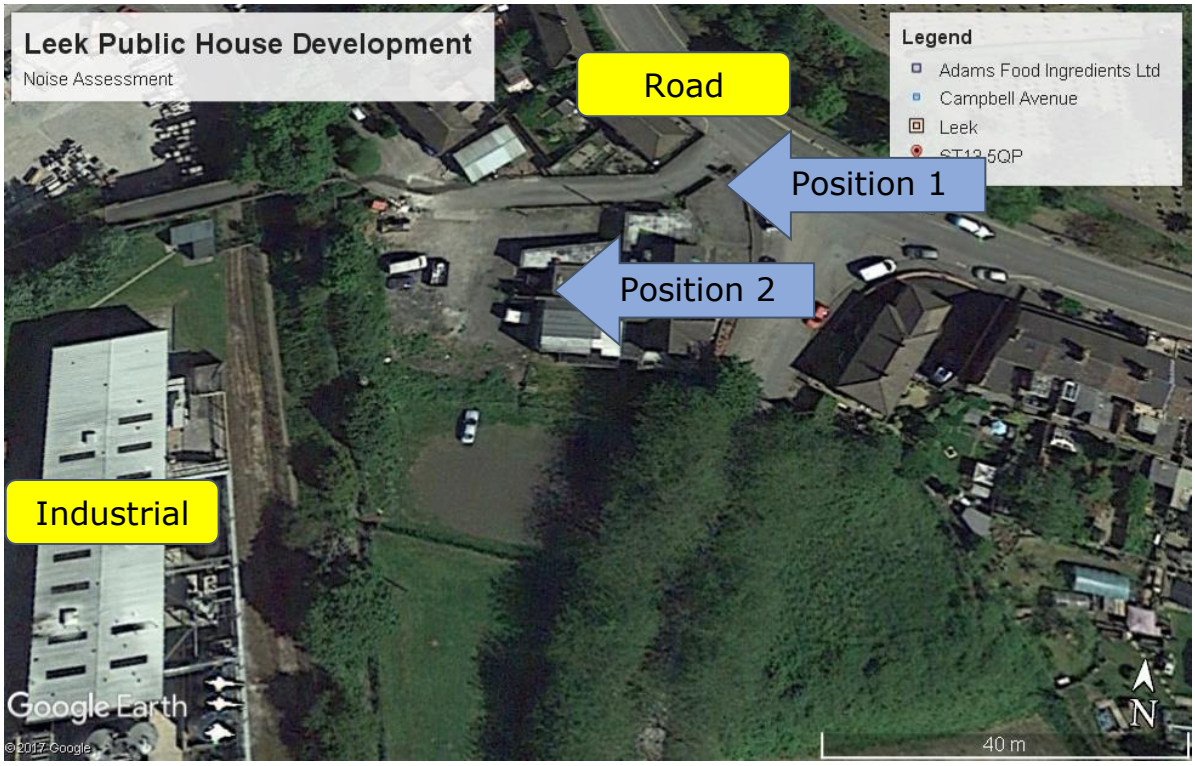
Acoustic terminology is explained at Appendix 1 of this report; the author's qualifications and experience are described in Appendix 2; site images are shown in Appendix 3 and formulae to calculate road noise in Appendix 4.

2.0 SITE DESCRIPTION

The site lies adjacent to Junction Road (to the north) and at the rear Leek Auctions is located to the south east (with a road running to this site). There is also an industrial estate with a variety of uses to the south west of the site off Barnfields Close / Road. It is understood that the business which is in clear view of the site is a cheese manufacturer at approximately 40m from the nearest façade (proposed). Measurements were made at approximately 53m and so to err on the side of caution a correction will be made for the difference in distance regarding the measured levels (+2dBA).

It is proposed to position 7 x plots for domestic dwellings on this land. The public house is closed and will be demolished prior to development.

Figure 1



As can be seen on the image above there are existing houses located both adjacent to the road and at a similar distance to the industrial uses and industrial estate.

3.0 ASSESSMENT CRITERIA

3.1 Condition 9 from Staffordshire Moorlands District Council Decision Notice (Ref SMD/2016/0334)

Condition 9

9. Development shall not commence until a site specific Noise Assessment and a Scheme for protecting the proposed residential units from external noise has been submitted to, and approved in writing by the Local Planning Authority. The submitted Scheme shall have due regard to the British Standard 8233:2014 (Sound insulation and noise reduction for buildings), and be designed to achieve noise levels of less than 35 dB LAeq in bedrooms, less than 40 dBLAeq in living areas and less than 55 dB Laeq in outdoor living areas. The development shall subsequently be carried out in accordance with the approved Scheme Pre completion tests shall be carried out to verify compliance with this condition and a report containing all raw data and showing how calculations have been made shall be submitted to the Local Planning Authority for its written approval before any of the units hereby approved are occupied. Reason: To protect occupiers from noise and safeguard their residential amenities.

3.2 NPPF National Planning Policy Framework

When considering applications for new residential development adjacent to existing noise sources, the relevant document is now NPPF. "National Planning Policy Framework". Section 123 of NPPF specifies:

Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts[27] 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;[28] 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.*

27 See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).
28 Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.

The national Planning Practice Guidance (PPG) web-based resource was launched by the Department for Communities and Local Government (DCLG) on 6 March 2014 to support the National Planning Policy Framework and make it more accessible. The overall aim of the guidance, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England, is to identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG:

Table 1

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No Specific Measures Required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect (NOEL)	No Specific Measures Required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Observed Adverse Effect	Prevent

The NPPF, NSPE and PPG:Noise do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the proposed development, national planning policy and appropriate guidance documents including the 'World Health Organisation Community Noise Guidelines' (1999) and 'BS 8233 – Guidance on Sound Insulation and Noise

Reduction for Buildings (2014), which presents the noise level criteria used as a basis for this assessment.

The PPG:Noise also states that neither the NPSE nor the NPPF (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the proposed development.

3.3 ProPG Professional Practice Guidance on Planning & Noise (May 2017) – excerpts are reproduced below

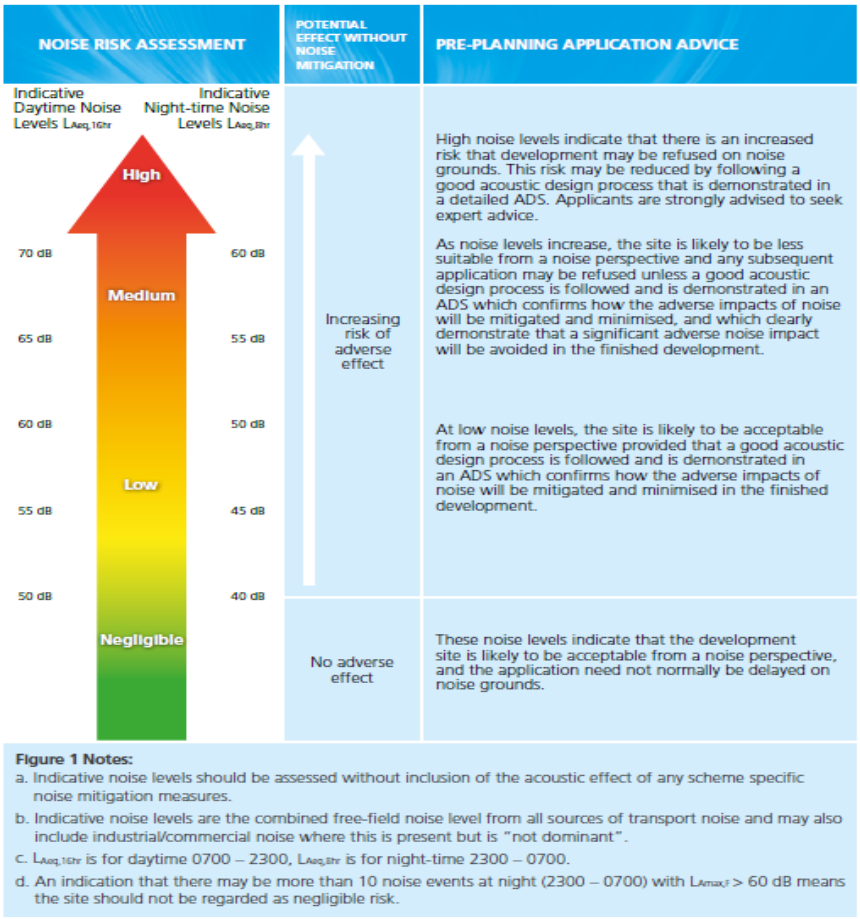
The Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The scope of ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources. New apartments, flats and houses are the most common type of new residential development; however, the guidance can also be applied to other types of residential developments such as residential institutions, care homes etc. The two sequential stages of the overall

approach are:

Stage 1 – an initial noise risk assessment of the proposed development site (see figure 2 below); and

Stage 2 – a systematic consideration of four key elements.

Figure 2 (Stage 1 Initial Assessment Noise Levels**)**



The overall **Stage 1** approach is considered to support wider Government planning and noise policy and guidance

at the date of publication of this document, including the NPPF, NPSE and PPG-Noise.

The noise risk assessment may be based on measurement or prediction (or a combination) as appropriate and should aim to describe noise levels over a "typical worst case" 24-hour day either now or in the foreseeable future.

The four key elements to be undertaken in parallel during **Stage 2** of the recommended approach are:

- **Element 1** – demonstrating a "Good Acoustic Design Process";
- **Element 2** – observing internal "Noise Level Guidelines";
- **Element 3** – undertaking an "External Amenity Area Noise Assessment"; and
- **Element 4** – consideration of "Other Relevant Issues".

The approach is underpinned by the preparation and delivery of an "Acoustic Design Statement" (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk. The choice of recommendation is as follows: "grant

without conditions", "grant with conditions", "avoid" or "prevent".

The recommended ProPG internal noise level guidelines are described in *Figure 2.* These guidelines reflect and extend current practice contained in BS8233:2014.

It should be noted that the acoustic performance of the building envelope will be reduced in the event windows are opened for ventilation or cooling purposes, typically reducing the insulation to no more than 10 to 15 dB(A). Most residents value the ability to open windows at will, for a variety of reasons.

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB LAeq,16hr."

Figure 2

ACTIVITY	LOCATION	07:00 – 23:00 HRS	23:00 – 07:00 HRS
Resting	Living room	35 dB $L_{Aeq,16\,hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16\,hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\,hr}$	30 dB $L_{Aeq,8\,hr}$ 45 dB $L_{Amax,F}$ (Note 4)

NOTE 1 The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

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 $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form **(see Section 3.D)**.

Following assessment, an Acoustic Design Statement (ADS) should provide sufficient evidence that the ProPG Stage 1 and Stage 2 Elements 1 to 4 have been followed. See figure 3 below.

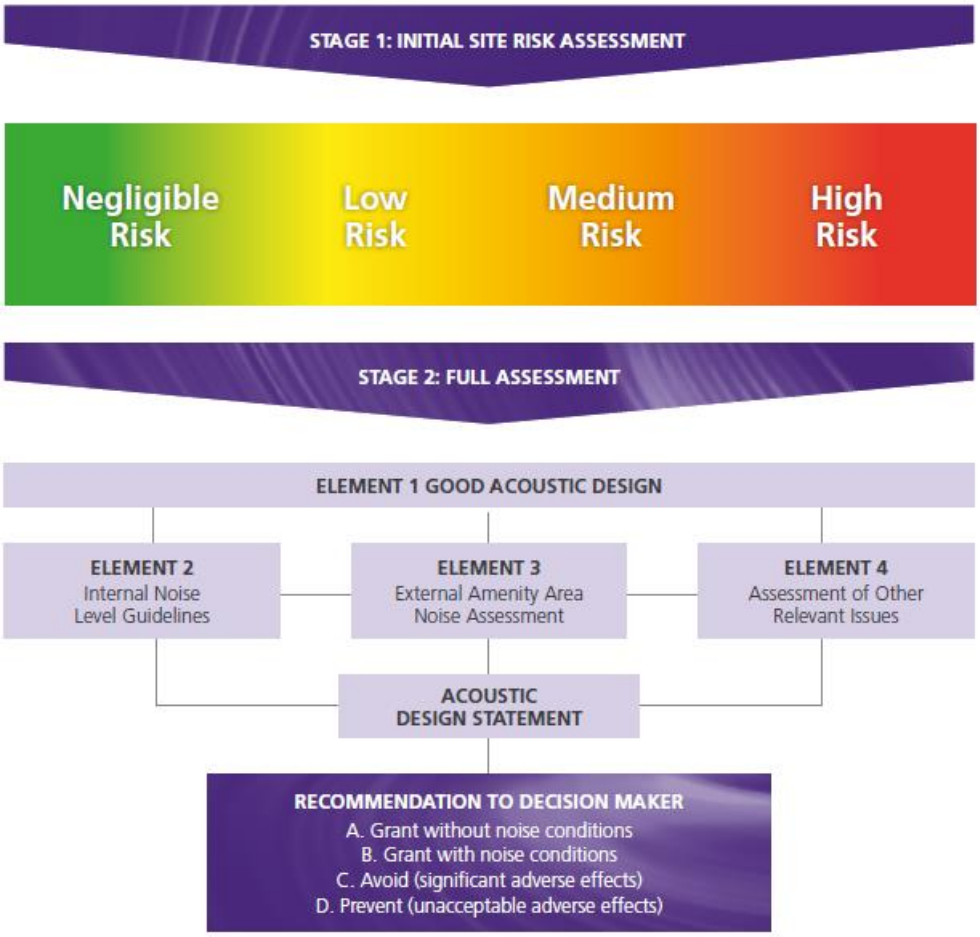
Figure 3

An ADS for new housing should be proportionate to the scale of development and the extent of noise risk at the development site. An ADS should typically address the following issues:

TYPICAL ISSUES FOR LOW NOISE RISK SITES	ADDITIONAL ISSUES FOR MEDIUM/HIGH NOISE RISK SITES
Relevant noise sources identified	Multiple source contributions carefully quantified
Assess extent of noise risk for unmitigated site (current and foreseeable future, 15 years ahead)	Greater coverage across the site (all buildings, all relevant heights)
	Alternative site layouts considered
	Adequate non-sensitive use for screening
Opportunities to mitigate the noise source within the site	Opportunities to mitigate the noise source outside owned land Physical mitigation, operational management
Maximise separation	Existing topographical advantages Change site level
Noise barriers – screening opportunities	Barriers inside and outside the site
Site layout – protecting residential units	Design external amenity spaces (e.g. balconies) to reduce noise entering sensitive rooms
Site layout – protecting external amenity space	Access to quiet open space on or off-site
Non-sensitive elements as screens	Non-sensitive elements designed as screens
Building layout to self-screen sensitive rooms	Orientation of noise sensitive rooms away from the source of noise exposure i.e. quiet facades
Building treatment to screen openings	Consideration of alternative acoustic options
Window location & size on affected facades	Innovative facade and window designs e.g. plenum windows
	Façade insulation design
Ventilation – natural, from quiet facade	Acoustic performance of ventilation, thermal comfort
	Complete Acoustic Design Process throughout

Summary for ProPg below (Figure 4).

Figure 4



3.4 British Standard 8233:2014 (Guidance on Sound Insulation and Noise Reduction for Buildings)

The latest version of BS.8233 "Guidance on Sound Insulation and Noise Reduction for Buildings", was published in February 2014. BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The

Standard states that it is "desirable" that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,\ T.}$ Where design standards cannot be achieved for traditional amenity spaces (e.g. gardens and patios) then the '*lowest practical levels*' should be achieved.

An extract of the "Design Range" of BS.8233's Table 4 for indoor noise levels (with Notes 4 & 7) appears below and it should also be noted that the assessment period is for the whole of the day (16 hours) or night (8 hours).

Table 4 **Indoor ambient noise levels for dwellings**

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

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 LAmax,P depending on the character and number of events per night. Sporadic noise events could require separate values.

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.

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T , with an upper guideline value of 55 dB LAeq,T. which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable."

3.5 WHO "Guidelines for Community Noise"

These guidelines entitled "Guidance for Community Noise"; were approved by the World Health Organisation and consider guideline values for annoyance in the community. These have been set at 50 or 55 dBA; representing daytime levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed, respectively. An extract of Table 4.1 from Section 4.4 appears below:

Table 4.1: Guideline values for community noise in specific environments (Extract).

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax, fast [dB]
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility and moderate annoyance, daytime and evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

The guidelines also suggest that; "*At night, sound pressure levels at the outside façades of the living spaces*

should not exceed 45 dB LAeq and 60 dB LAmax, so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB." LAeq for daytime is for 16 h and for night time 8h.

BS8223 is based on the WHO Guidelines and as can be seen has similar values.

4.0 NOISE LEVEL INFORMATION

4.1 Existing Noise Climate

Methodology

The site was visited on Wednesday 25th October 2017 and monitoring equipment was installed at the rear of the site for over 24-hours (at a first-floor roof space overlooking the industrial site Grid Ref SJ98040 55685). Measurements were also made at the front of the site, considering road noise, at the intended position of the façade closest to the road (Grid Ref SJ98060 55706) using the shortened methodology from CRTN.

The monitoring positions were situated in free-field conditions.

The weather conditions during the monitoring period were dry, with cloud cover of approximately 70%. There was a wind speed of 0.5-3.5m/s (SW) measured on an anemometer; the temperature was around 9-13 degrees Centigrade.

The sound level meters used were an integrated Type 1 Svan 977 (s/n 36870) and Cirrus 821:B (s/n C18361FE) and microphone systems mounted on a tripod and fitted with outdoor case (Cirrus) and windmuffs. The meters calibrated correctly before and after the measurements using a Cirrus calibrator type CR:551E (s/n 039816); the instrumentation had been laboratory calibrated within the preceding 2 years.

4.2 Results and Calculations

Period measurements are shown below in Tables 2-5.

Table 2 – Rear (Industrial View) Daytime

Date	Time	Run Time	Leq	Lmax	L1	L10	L50	L90	L95	Lmin
25/10/2017	12:00	01:00:00	57.0	78.2	60.5	57.5	56.4	55.5	55.3	53.7
25/10/2017	13:00	01:00:01	56.7	66.6	59.0	57.2	56.3	55.6	55.4	53.9
25/10/2017	14:00	01:00:03	58.0	72.6	61.3	59.2	57.2	56.0	55.7	54.1
25/10/2017	15:00	01:00:00	56.6	79.4	59.2	57.0	56.1	55.5	55.4	54.4
25/10/2017	16:00	01:00:04	57.1	74.1	61.4	57.6	56.5	55.8	55.7	54.4
25/10/2017	17:00	01:00:01	57.0	74.6	60.4	57.4	56.5	55.8	55.6	54.5
25/10/2017	18:00	01:00:05	56.7	81.6	59.1	56.8	56.0	55.5	55.3	54.4
25/10/2017	19:00	01:00:01	56.4	67.3	57.8	56.8	56.0	55.4	55.2	54.0
25/10/2017	20:00	01:00:01	56.4	68.8	58.3	56.8	56.0	55.4	55.3	54.2
25/10/2017	21:00	01:00:02	56.3	71.9	57.7	56.8	56.0	55.4	55.2	54.2
25/10/2017	22:00	01:00:02	56.5	70.2	57.8	57.0	56.2	55.5	55.3	54.3
26/10/2017	07:00	01:00:02	57.1	74.9	63.7	57.7	56.4	55.1	54.8	53.5
26/10/2017	08:00	01:00:00	61.1	80.2	72.8	59.8	57.8	56.4	56.2	54.7
26/10/2017	09:00	01:00:01	74.2	92.4	86.9	75.1	69.6	57.2	56.6	55.1
26/10/2017	10:00	01:00:01	67.5	90.3	78.7	69.2	57.4	56.1	55.9	54.6
26/10/2017	11:00	01:00:01	60.1	84.3	68.3	61.1	56.8	56.0	55.8	54.6
26/10/2017	12:00	01:00:02	59.7	90.8	69.5	58.6	56.8	56.0	55.8	54.6
26/10/2017	13:00	01:00:00	56.8	72.2	58.7	57.2	56.4	55.6	55.4	54.2
26/10/2017	14:00	01:00:06	56.8	77.1	58.7	57.2	56.3	55.5	55.3	54.1
26/10/2017	15:00	01:00:02	56.9	70.2	58.8	57.6	56.5	55.6	55.4	54.3
26/10/2017	16:00	01:00:08	56.8	67.1	58.7	57.3	56.4	55.7	55.6	54.6
		Total Run	Leq dB	Highest						
		21:00:43	63.1	92.4						

Table 3 – Rear (Industrial View) Night time

Date	Time	Run Time	Leq	Lmax	L1	L10	L50	L90	L95	Lmin
25/10/2017	23:00	01:00:07	55.4	68.8	56.9	56.3	55.0	53.8	53.7	52.4
26/10/2017	00:00	01:00:03	54.8	59.2	56.1	55.4	54.4	53.8	53.6	52.5
26/10/2017	01:00	01:00:02	54.8	59.1	56.0	55.4	54.4	53.9	53.7	52.7
26/10/2017	02:00	01:00:03	55.1	62.5	56.5	55.7	54.7	54.1	53.9	52.9
26/10/2017	03:00	01:00:01	55.3	62.6	56.4	55.8	54.9	54.2	54.0	53.0
26/10/2017	04:00	01:00:06	55.1	59.5	56.3	55.6	54.8	54.1	54.0	53.0
26/10/2017	05:00	01:00:01	55.8	66.9	58.7	56.6	55.2	54.4	54.2	53.2
26/10/2017	06:00	01:00:02	56.0	70.6	62.8	56.4	55.2	54.4	54.2	53.1
		Total Run Time	Leq dB	Highest						
		08:00:25	55.3	70.6						

Table 4 – Front (Road Traffic)

Date & time	Filename	Elapsed time	LAeq	LAFmax	LAFmin	L01	L10	L50	L90	L95
25/10/2017 13:00:03	@78575	01:00:00	63.0	94.7	44.0	70.4	65.3	56.2	47.7	46.7
25/10/2017 14:00:38	@78576	01:00:00	62.2	82.2	43.0	71.8	66.1	57.6	46.5	45.5
25/10/2017 15:00:38	@78577	01:00:00	61.8	81.6	37.5	71.1	65.8	57.4	46.8	45.7

Table 5 – 1/1 Octave Band average over entire period (Front)

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz
59.1	55.8	56.5	59.4	55.6

In addition to the above, the maximum readings were recorded and the typical LAmax level for the front was 75dB and for the rear 58dB, with occasional incidents above those levels (see figures 7-9). From ProPG, internal levels should not exceed 45dB LAmax, F more than 10 times per night.

When considering maximum noise levels generated by road traffic, it is generally found that these levels are not governed by the volume of traffic, but by specific single events such as a car or motorbike passing by at high speed, an empty lorry passing over bumps or potholes in a section of road, a car horn, emergency siren or a vehicle skidding (see impression below).

4.3 Subjective Impressions

At the front of the site, to the observer, road noise was clearly the principal and dominant source of noise. Other sources including occasional resident activities, dogs barking and bird song.

To the rear there was a distinct, audible, steady but anonymous noise from an industrial source e.g. a distant industrial extraction system.

5.0 ASSESSMENT AND DISCUSSION

5.1 Industrial Noise – Rear of Site

It was clear to the observer that noise at the rear (cheese factory) was steady and anonymous (a hum) possibly from a distant extraction system or similar. The standard BS4142:2014 (Methods for rating and assessing industrial and commercial sound) is normally referenced for industrial-type noise. However, as the noise at this site was steady, anonymous and as the results suggest, operational for 24-hours then BS8233 / ProPG have been

used in order to determine design for achieving desirable external and internal noise levels.

There were unusual events between 9.10am and 9.27am where the LAmax levels were consistently above 80dB. This increased the LAeq, 1-hour level above the other daytime levels for this hour. The events could have been due to resident activities in close proximity to the meter as the roof space was accessible, but this could not be confirmed. We propose to remove this anomalous hour, which would result in a daytime level LAeq of 59.2dB and not 63.1dB.

Daytime = $L_{Aeq\ (16hr)}$ = 59.2dB
Night time = $L_{Aeq\ (8hr)}$ = 55.3dB

Because three of the proposed dwellings will be positioned closer to the cheese factory than the rear monitoring position then a correction will be made as a precaution, in case the sources of noise from the factory are also located closer to the site.

20LOG (measurement position distance/façade distance) = +2.4dB

Daytime = $L_{Aeq\ (16hr)}$ = **61.6dB**
Night time = $L_{Aeq\ (8hr)}$ = **57.7dB**

It is clear from the table above (tables 3) that the anonymous "hum" from the distant anonymous industrial source, audible to the observer is also present at night with noise levels being reasonably constant LAeq and throughout the percentiles, L1-L90.

5.2 Road Noise – Front of Site

The assessment of road noise is based on the shortened 3-hour measurement technique, which is detailed in the Department of Transport document, "Calculation of Road Traffic Noise". Three consecutive one-hour measurements of the L_{A10} were made to estimate the $L_{A10(18hr)}$, from which the $L_{Aeq(16hr)}$ can be calculated.

The DEFRA publication "*Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping"* [5] includes formulae (shown at Appendix 4) to convert $L_{A10,\ 18Hr}$ into L_{Day} (07:00-19:00), LAeq,8hr (L_{Night}), Levening (19:00-23:00) and LAeq,16hr which give results for non-motorways of:

LAeq,16hr = **62.3dB**

5.3 Night time Levels (23:00 to 07:00)

The same DEFRA publication can be used to calculate night time levels, LAeq,8hr which give results for non-motorways of:

LAeq,8hr = **54.5dB**

5.4 Overall Levels

Daytime = $L_{Aeq\ (16hr)}$ **= 62.3dB**
Night time = $L_{Aeq\ (8hr)}$ **= 54.5dB**

5.5 ProPG Stage 1

For an initial assessment the following table can be referred for indications of suitability:

Table 6

Level Day	Level Night	Risk	Conclusion
Below 50 dB(A) day	Below 40 dB(A) at night	Negligible Risk	Site is likely to be acceptable
Between 50 and 60-65 dB(A) day	Between 40 and 50-55 dB(A) night	Low Risk	Likely to be acceptable provided that Good Acoustic Design (GAD) is followed
Between 60-65 and 70 dB(A) day	Between 50-55 and 60 dB(A) night	Medium Risk	Likely to be less suitable and application may be refused unless ADS demonstrates GAD, how adverse effects will be mitigated, and significant adverse effects avoided
Above 70 dB(A) day	Above 60 dB(A) night	High Risk	Increased risk of refusal, which may be reduced by demonstrating GAD in a detailed ADS, expert advice recommended

Outline planning has already been approved. Noise levels to the front of the site and rear during the daytime suggests that the site is "Low Risk" and likely to be acceptable provided that Good Acoustic Design (GAD) is followed. For the rear, where we have erred on this side of caution, again as long as GAD is followed this will also be the case – external levels for rooms facing the industrial site at 57.7dBA (2.7dBA above the approximate low risk range).

5.6 LAmax Levels

When considering the LAmax criterion from ProPG then internal levels of 45dB LAFmax for individual noise events are not likely to exceed this level regularly at night given the typical values at the monitoring positions and as calculated below (windows closed with a view of the road).

5.7 Internal Levels

Detailed internal levels have been calculated below using the typical octave band levels (see above) for the higher-level façade and an example construction using the methodology described in BS EN 12354-3:2000 [6].

5.8 Outdoor Levels (ProPG and WHO)

Outdoor levels ideally should not exceed 50/55dBA to ensure that any possible annoyance is avoided. The plans (see appendix) suggest that principal gardens or outdoor amenity areas will be located both to the rear of the buildings.

For plots facing the road screening will likely be provided by the buildings themselves (see plan) and are thus likely to achieve levels within this range – with some additional short sections of fencing as shown below – green line).

For gardens facing the rear industrial site LAeq, 16hrs and a daytime level of 61.6dB, then an additional minimum 6.6dBA of attenuation would be necessary and at 62.3dB for the plots facing the road, 7.3dB of attenuation.

Close boarded fencing of sufficient length, height and density (1.8m height) would be adequate (free from gaps and holes). With a "partial view" of the factory from the nearest (Plot 7) rear garden and road (Plot 4) – assumed 90 degree angle view (probably less) then it is estimated below that 7.3dBA and 8.3dBA can be achieved for the nearest plot facing the industrial site and nearest plot facing the road respectively. In practice the buildings are likely to increase the actual level of screening in most positions in the rear gardens except the edges where there may be a partial view, at the extremities.

Table 7 - Fencing

Location		Garden Plot 7	Garden Plot 4
Ht of Ground at Receiver AoD		0	0
Ht of Receiver Abv local grnd		1.4	1.4
Dist of Receiver from Source		45	20
Ht of Source		4	1.5
Angle of View		90	90
Proportion of Soft Ground		0	0
Height of Propagation Path		0.95	0.95
Barrier 1	Ht of Ground at Barrier AoD	0	0
	Ht of Barrier Abv local grnd	1.8	1.8
	Dist of Barrier top from Source	35	3
Soft Grounnd Attenuation		0.0	0.0
Net Barrier Effect		-4.3	-5.3
Angle of View Correction		-3.0	-3.0
Total Attenuation		**-7.3**	**-8.3**

Figure 5



The maximum attenuation obtained with a practical barrier is about 15 to 20dBA at around 15kg/m2.

BS8233:2014 suggests that where design standards cannot be achieved for traditional amenity spaces (e.g. gardens and patios) then the '*lowest practical levels*' should be achieved.

Therefore, higher levels than would normally be desirable (from the previous version of BS8233) may now be acceptable.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Internal Levels

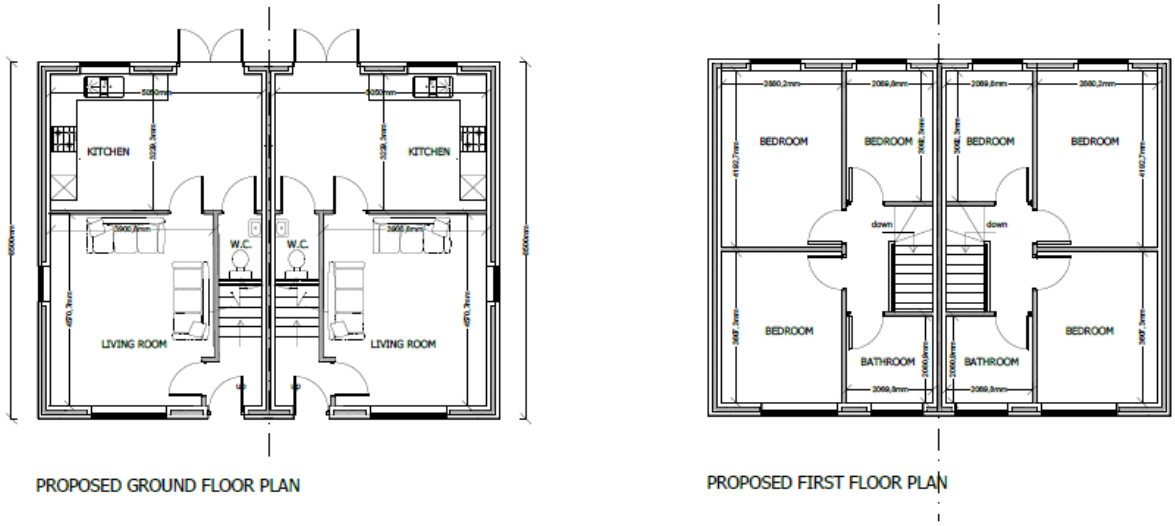
Detailed internal levels have been calculated using the typical octave band levels (see above) and an example construction using the methodology described in BS EN 12354-3:2000 [6]. An example of suitable construction and glazing is also described below to achieve target levels.

Because of the road noise to the front and anonymous, steady noise to the rear it may not be possible to achieve desirable internal levels for bedrooms when windows are opened if they have a clear view of these sources of noise - assuming 10 to 15dBA attenuation for a partially open window (from ProPG).

Therefore, the following acoustic design considers alternative ventilation for these rooms, where applicable and assuming the following from available plans:

- Reverberation time is 0.3s for bedrooms
- Reverberation time for living rooms is 0.5s
- Volume for smallest bedroom facing the road = 16m^3
- Volume for smallest bedroom facing the factory = 14m^3
- Window areas for both bedrooms = 2m^2
- Wall Area = 10m^2
- Brick / block cavity construction
- Tiled/slated roof, plasterboard ceiling, absorbing layer above the ceiling (e.g. mineral wool loft insulation)

Figure 6 – Internal Layout (semi-detached x 2)



PROPOSED GROUND FLOOR PLAN

PROPOSED FIRST FLOOR PLAN

Figure 7 – (Internal Layout – Terraced Row x 1)



6.2 Example Construction and Glazing

Table 8 – Bedrooms overlooking Road

BS EN 12354-Calcs		Use	Volume		Volume	16.0				
Version 3.8		length							dBA Diff	33.49518
© 2014 Martec Environmental Consultants Ltd		width			RT	0.3				
& Acute Acoustics Ltd		height			Octave Band Centre Frequency [Hz]					dBA
					125	250	500	1k	2k	
	External Spectrum Leq (Free Field & Linear)				59.1	55.8	56.5	59.4	55.6	62.1
	Adjustment to Given Level if required									62.3
	External Spectrum Adjusted for Level				59.3	56.0	56.7	59.6	55.8	62.3
			Area m2		Element Sound Reduction Index [SRI]					Contrib
Wall	Brick/block/cavity		10.0		41	45	45	54	58	15.4
Drs/Wndws	Saint-Gobain 4/20/4		2.0		21	20	27	38	41	27.9
Roof Lights	None		0.0		0	0	0	0	0	0.0
Door	None		0.0		0	0	0	0	0	0.0
Roof	None		0.0		0	0	0	0	0	0.0
			# Vents							
Vent Dn,e	Powered_attenuated_vent_-_NIR_1975_(4000mm^2)		2.0		38	38	46	53	60	20.2
										dBA
		Internal SPL/dBLin			35.9	33.3	27.1	19.8	12.3	28.8

For bedrooms with a clear view of the road (semi-detached properties) it can be seen that the predicted internal daytime noise level of **28.8dB LAeq,16hr** using Saint Gobain double glazing [4/20/4] with alternative mechanical ventilation would meet the daytime criteria of 35dB LAeq, 16hr from BS8223:2014 for bedrooms and the criteria from Condition 9 (Staffordshire Moorlands District Council) without the need to open windows for purge ventilation in the Summer months.

Given the reduction of between **-7.8dBA** for night time noise levels then the desirable internal level of 30dB LAeq, 8hr from BS8223:2014 for bedrooms would also be met [28.8 – 7.8 = **21.0dB**].

LAmax levels are typically around 75dB. Given the predicted difference between external and internal levels of 33.5dB this would equate to internal levels of **41.5dB LAmax** [75 – 33.5] which meets the LAmax criteria of 45dB LAmax (ProPG).

Table 9 – Bedrooms Overlooking the Industrial Site

BS EN 12354-Calcs		Use	Volume		Volume	14.0				
Version 3.8		length							dBA Diff	32.91526
© 2014 Martec Environmental Consultants Ltd & Acute Acoustics Ltd		width			RT	0.3				
		height		Octave Band Centre Frequency [Hz]						dBA
				125	250	500	1k	2k		
	External Spectrum Leq (Free Field & Linear)			59.1	55.8	56.5	59.4	55.6		62.1
	Adjustment to Given Level if required									61.6
	External Spectrum Adjusted for Level			58.6	55.3	56.0	58.9	55.1		61.6
			Area m2	Element Sound Reduction Index [SRI]						Contrib
Wall	Brick/block/cavity		10.0	41	45	45	54	58		15.2
Drs/Wndws	Saint-Gobain 4/20/4		2.0	21	20	27	38	41		27.8
Roof Lights	None		0.0	0	0	0	0	0		0.0
Door	None		0.0	0	0	0	0	0		0.0
Roof	None		0.0	0	0	0	0	0		0.0
			# Vents							
Vent Dn,e	Powered_attenuated_vent_-_NIR_1975_(4000mm^2)		2.0	38	38	46	53	60		20.1
										dBA
		Internal SPL/dBLin		35.8	33.2	27.0	19.7	12.2		28.7

For bedrooms with a clear view of the industrial building (row of three terraced houses) it can be seen that the

predicted internal daytime noise level of **28.7dB LAeq,16hr** using Saint Gobain double glazing [4/20/4] with alternative mechanical ventilation would meet the daytime criteria of 35dB LAeq, 16hr from BS8223:2014 for bedrooms and the criteria from Condition 9 (Staffordshire Moorlands District Council) without the need to open windows for purge ventilation in the Summer months.

Given the reduction of **-3.9dBA** for night time noise levels then the desirable internal level of 30dB LAeq, 8hr from BS8223:2014 for bedrooms would also be met [28.7 – 3.9 = **24.8dB**].

LAmax levels are typically around 58dB. Given the predicted difference between external and internal levels of 32.9dB this would equate to internal levels of **25.1dB LAmax** [58 – 32.9] which meets the LAmax criteria of 45dB LAmax (ProPG).

For all other rooms (with no clear view of either the road or industrial site, standard thermal glazing with trickle ventilation should be sufficient.

6.3 Summary

The above demonstrates that with considered specification appropriate noise levels can be met with reference to BS8233: 2014 and the requirements of Staffordshire Moorlands District Council / High Peak Borough Council.

The following noise control measures are recommended:

- For external levels the proposed dwellings with some additional screening provided by fencing as suggested will provided sufficient attenuation for rear gardens / amenity spaces.

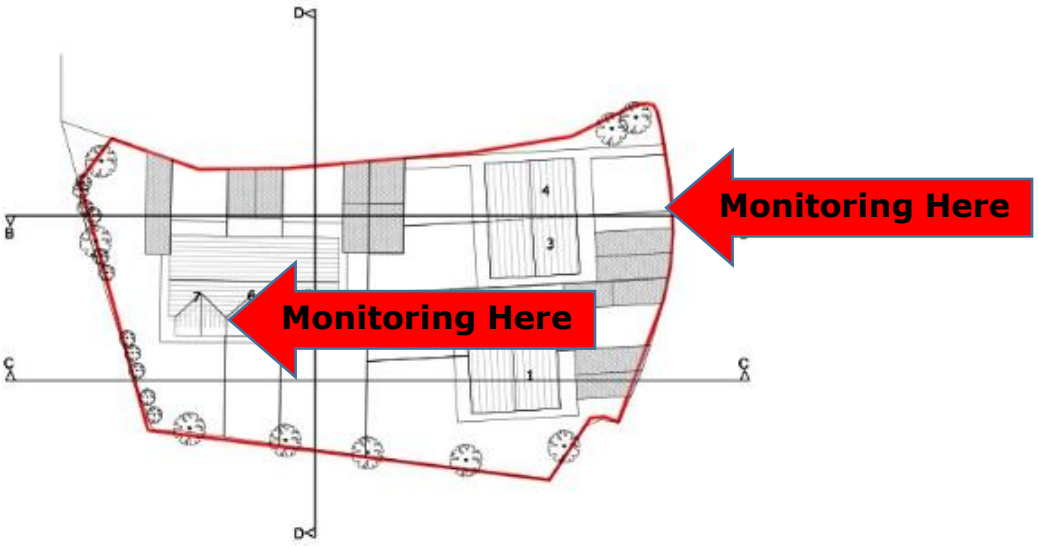
- For all habitable rooms which have a view of the road or factory, windows fitted with Saint-Gobain 4/20/4 or similar / better specification with mechanical ventilation (so windows do not have to opened at night), will achieve desirable internal levels. All other windows can be fitted with standard thermal glazing.

- A Mechanical Extract Ventilation (MEV) or Positive Input Ventilation (PIV) system will extract/supply air

from the room but will not allow significant noise to enter from the outside, either because of the system's attenuation or because it vents to a quiet façade. Residents could then occupy these rooms without the need to open the windows. The units can be specified for applicable rooms or whole house – example systems can be found at:

https://www.nuaire.co.uk/residential/new-build

Figure 8:
Site Location Plan
(and measurement positions)



Figures 9 to 11: dB LAmax

(LAmax Monitoring Position Front)

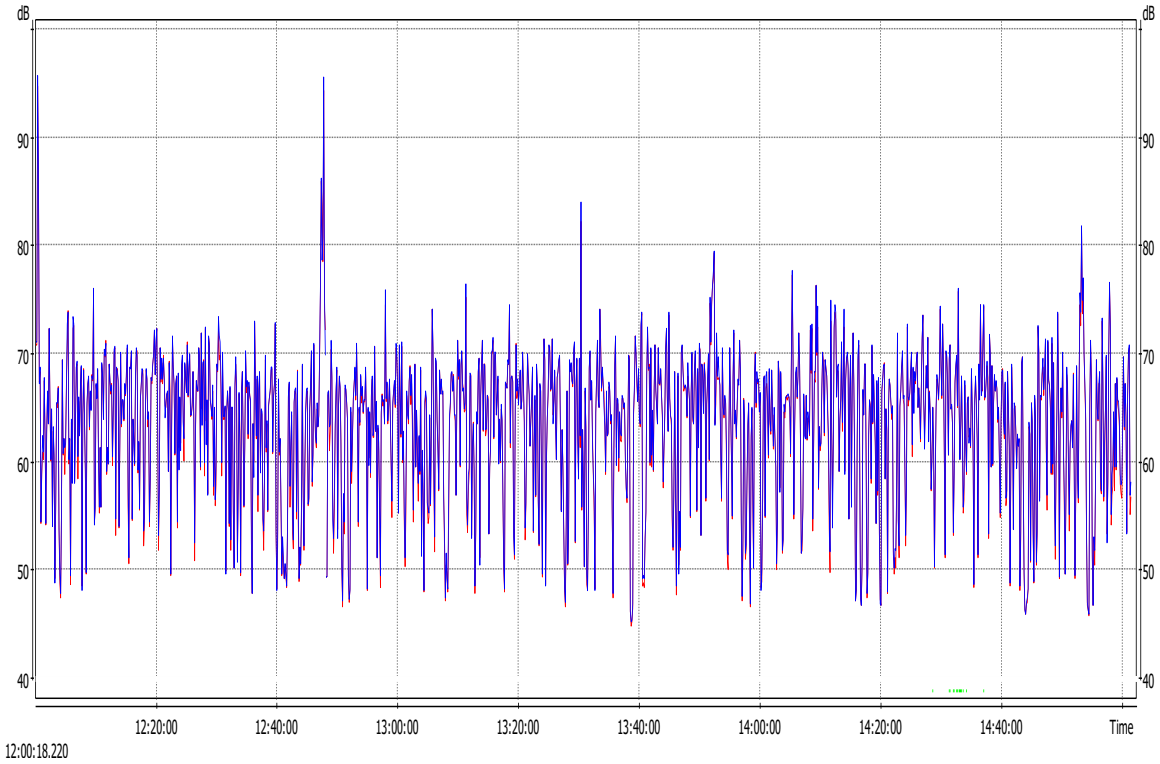


Figure 9

(LAmax Monitoring Position Rear)

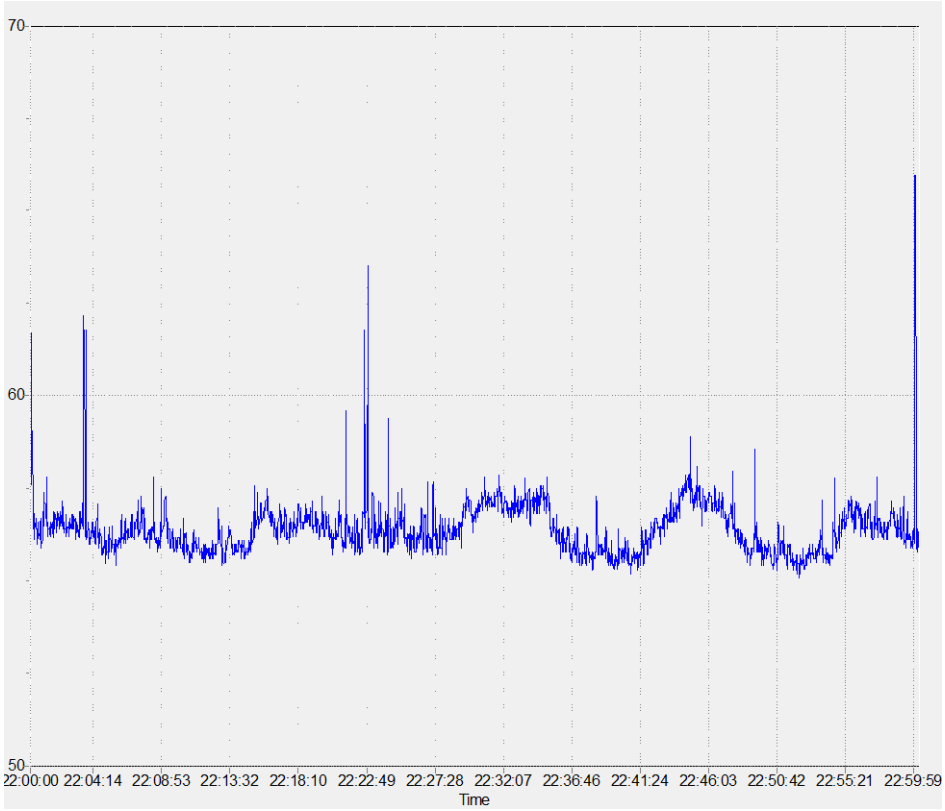


Figure 10



Figure 11

"Unusual events" – approx. 20 minutes and then 5minutes (not road or factory noise) possibly closer to the meter and raising LAmax levels for this period

APPENDIX 1

EXPLANATION OF ACOUSTIC TERMS

The dB or the decibel, is the unit of noise. The number of decibels or the level, is measured using a sound level meter. It is common for the sound level meter to filter or 'weight' the incoming sound so as to mimic the frequency response of the human ear. Such measurements are designated **dB(A)**.

A doubling of the sound is perceived, by most people, when the level has increased by 10 dB(A). The least discernible difference is 2 dB(A). Thus, most people cannot distinguish between, say 30 and 31 dB(A).

If a noise varies over time then the **equivalent continuous level, or LAeq**, is the notional constant level of noise which would contain the same amount of acoustic energy as the time varying noise.

The following table gives an indication of the comparative loudness of various noises expressed in terms of the A weighted scale:

Source of noise	**dB(A)**	**Nature of Noise**
Inside Quiet bedroom at night	30	Very Quiet
Quiet office	40	
Rural background noise	45	
Normal conversational level	60	
Busy restaurant	65	
Typewriter @ 1m	73	
Inside suburban electric train	76	
Alarm clock ringing @ .5m	80	
Hand clap @ 1m	80	
HGV accelerating @ 6m	92	Very Loud

APPENDIX 2

QUALIFICATIONS AND EXPERIENCE OF S.B. MELLOR

My full name is Steven Brian Mellor. I am the principal of the firm of SBM Safety Solutions Ltd, a consultancy company that specialises in health, safety and environmental services including noise assessment and control.

I hold a Master's degree in Health, Safety and Environmental Law, British Occupational Health Society (BOHS) M104 certificate in Noise and Vibration and Institute of Acoustics Certificate of Competence in Environmental Noise Measurement (Derby University) and Diploma in Acoustics and Noise Control (Bristol University). I am a member of the professional body for noise and vibration specialists, the Institute of Acoustics - MIOA.

I have some 16 years of experience dealing with problems caused by noise and vibration, both regarding noise and vibration in the environment, the workplace and the home. The firm of SBM Safety Solutions Ltd. was formed 15 years ago. During that time, we have advised many groups including employers, residents and developers about the problems of noise and vibration in the workplace and environment.

APPENDIX 3

Views of the Site and Location



Monitoring – rear



Rear view – existing houses



Industrial estate



Monitoring - front



Front – road traffic



View of site - front

APPENDIX 4

Formulae to Convert LA10,18h to Lday, Lnight and Levening

For non-motorway roads:

$$L_{day} = 0.95 \times L_{A10,18h} + 1.44 \text{ dB} \quad \textit{(Equation 1)}$$

$$L_{evening} = 0.97 \times L_{A10,18h} - 2.87 \text{ dB} \quad \textit{(Equation 2)}$$

$$L_{night} = 0.90 \times L_{A10,18h} - 3.77 \text{ dB} \quad \textit{(Equation 3)}$$

For motorways:

$$L_{day} = 0.98 \times L_{A10,18h} + 0.09 \text{ dB} \quad \textit{(Equation 4)}$$

$$L_{evening} = 0.89 \times L_{A10,18h} + 5.08 \text{ dB} \quad \textit{(Equation 5)}$$

$$L_{night} = 0.87 \times L_{A10,18h} + 4.24 \text{ dB} \quad \textit{(Equation 6)}$$

Formula to convert Lday and Levening into LAeq,16hr

$$L_{Aeq,16h} = 10 \log_{10}\left[\frac{1}{16}\right]\left[12 \times 10^{L_{day}/10} + 4 \times 10^{L_{evening}/10}\right] dB$$