NOISE ASSESSMENT

RUSHTON SPENCER

MOSS COTTAGE, RUSHTON SPENCER, SK11 0QU

PLANNING REF: SMD/2019/0655

Report by
S.B. Mellor MA, MIOA, CMIOSH
SBM Safety Solutions Ltd.

Report Date: 8th January 2020
Ref.: E16290. CRTN ProPG BS8233
Site Visited: 9th December 2019
Site Visited by: S.B. Mellor
Signed:



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SBM Safety Solutions Ltd. RSM House, 2, Betley Hall Gardens, Betley, Crewe, Cheshire, CW3 9BB
Tel/Fax: 0800 7879006 **Email**: enquiries@sbmsafetysolutions.co.uk **Website**: www.sbmsafetysolutions.co.uk
Company Registration No: 5014335 VAT Reg. No. 892005040

1.0 INTRODUCTION

At the request of Mrs. C. Hollies, land and building owner, SBM Safety Solutions Ltd undertook a noise assessment in connection with the proposal to develop land and an existing building (barn) off Leek Old Road (A523), Rushton Spencer, SK11 0QU for residential use.

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Transportation and other sources of noise (where applicable) would be examined where they could affect future residents of this development.

This report considers measurements made on site, the requirements of NPPF and current standards such as BS8233:2014, BS4142:2014, ProPG plus other appropriate criteria (as detailed below); and makes recommendations as necessary.

Acoustic terminology is explained in Appendix 1 of this report; The author's qualifications and experience are described in Appendix 2; Views of the site in Appendix 3 and Method for Converting the UK Road Traffic Noise in Appendix 4.

2.0 SITE DESCRIPTION

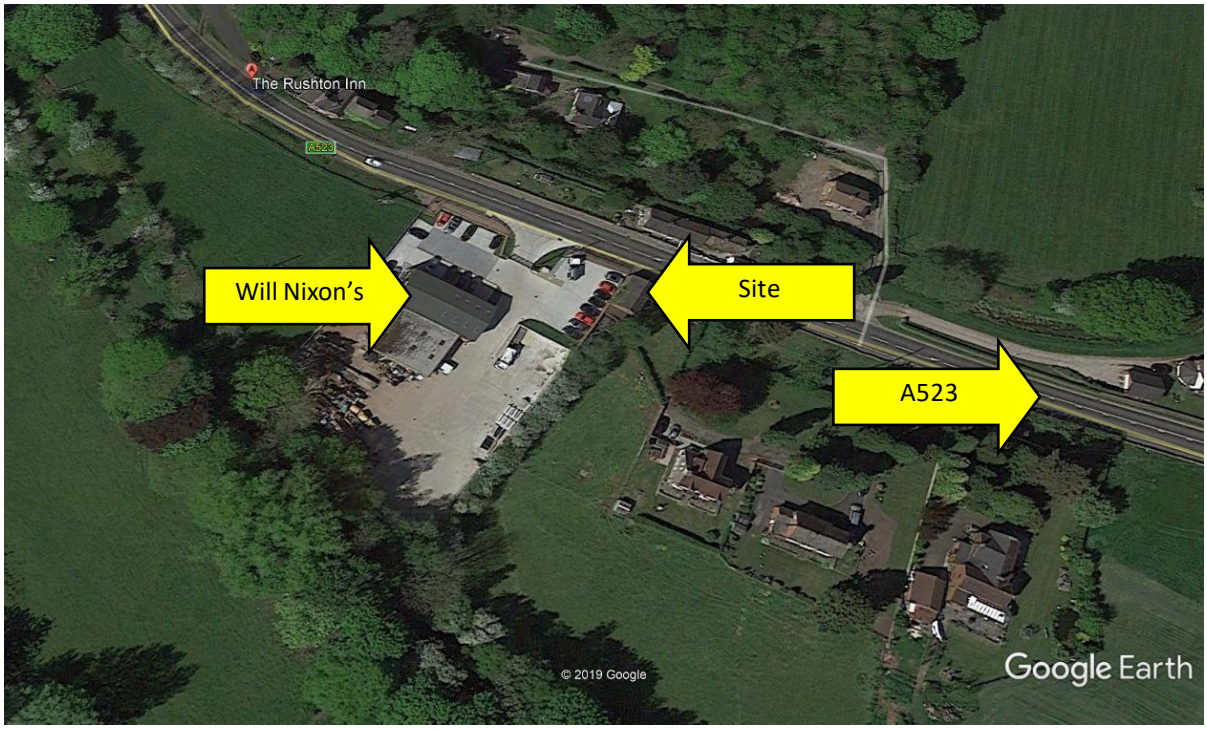
The site lies adjacent to the A523, a reasonably busy road with all types of vehicles regularly passing the site, many at speeds clearly above the 40mph limit at this section of the road. The existing barn is situated at just 3m (approximately) from the A523 at the narrowest position.

There is a commercial unit at approximately 25m from the western boundary. This is the head office of Will Nixon Construction Group Ltd.

The location could be defined as semi-rural.

There are existing properties located at similar distances to the both the road and Will Nixon's. (See figure 1 below).

Figure 1



Source – Google Earth

The dominant and principal source of noise is from road traffic.

3. ASSESSMENT CRITERIA

3.1 NPPF (National Planning Policy Framework)

When considering applications for new residential development adjacent to existing noise sources, the relevant document is the "National Planning Policy Framework" or NPPF (2019). This replaces an earlier version.

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 original 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.

3.2 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; and
Stage 2 – a systematic consideration of four key elements.

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.

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)**.

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."

ProPG Stage 1

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

Table 2

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

3.3 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."

3.4 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.

3.5 BS4142:2014 – Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

BS4142:2014 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…This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature".*

This British Standard describes a method for assessing whether a specific sound may have an adverse impact.

The Standard requires that the ambient noise *(**totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far)*** including the "specific" sound from the source in question is measured in terms of the

equivalent continuous sound level LAeq [see Appendix 1 for acoustic terms], which is then corrected for the residual sound (total LAeq excluding the "specific" sound).

A correction for character is made if "***a tone, impulse or other characteristic occurs".*** For tonality a correction of between +2dB and 6dB is considered acceptable and for impulsivity between 3 and 9dB. See table below.

Table 3

Character	**Just Perceptible**	**Clearly Perceptible**	**Highly Perceptible**
Tonality	+2dB	+4dB	+6dB
Impulsivity	+3dB	+6dB	+9dB

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.

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.

The final figure, including any character correction is known as the Rating level.

This Rating Level is then compared with the measured background [LA90] level. The greater this difference the greater the likelihood of "adverse impact" (See Notes 1 & 2 from BS4142:2014 below).

NOTE 1

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

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

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

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

NOTE 2

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

It can be seen from Section 3.3 above that the conclusions to a BS4142 assessment also depend on the context and Section 11 of the British Standard states:

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following...

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i. facade insulation treatment;

ii. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and

iii. acoustic screening."

4.0 NOISE LEVEL INFORMATION

4.1 Existing Noise Climate

Methodology

The site was visited on Monday 9th December 2019 and SBM Safety Solutions installed noise monitoring instrumentation at the position of the boundary of the site closest to the A523. Measurements were also taken for the same period at the rear of the existing building on a flat roof with the equipment extended above the boundary fence (at an approximate first floor position) overlooking the adjacent industrial yard.

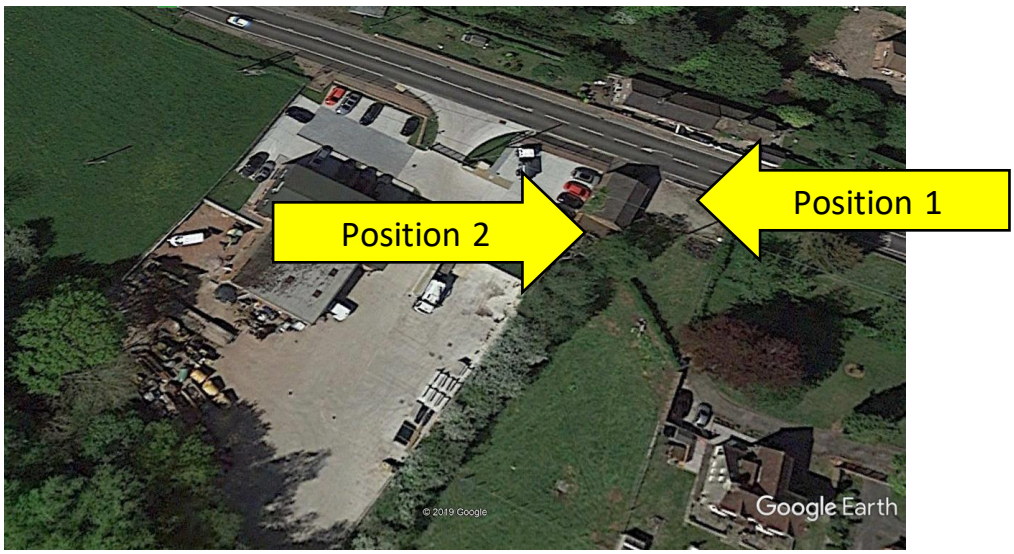
The methodology was discussed and agreed with Dennis Colgan who suggested the following:

1. *The shortened measurement procedure in CRTN is appropriate for the site. The consideration of noise and sound insulation under PROPG is also accepted.*

2. *The commercial unit adjacent to the site should be considered. There is a parking area and a site access next to the proposed dwelling which maybe likely to cause disturbance, I am not aware of any plant noise and machinery but commercial noise should be investigated. There are noise conditions applying to the commercial site but these are relevant to pre-existing housing and most will not be relevant to this potential new residential unit. From what I can gather the commercial site only operates between 07:30 and 18:00 Monday to Saturday but it would be important to understand the noise environment existing at the site.*

As noted above, the monitoring position for road noise was approximately 3m from the edge of the A523. The rear position for Nixon's yard is also shown in Figure 3 below.

Figure 3



Grid reference position 1 – SJ 9341162773

Grid reference position 2 – SJ 93394 62771

The monitoring positions were situated under free-field conditions.

The weather was dry, cloudless and sunny and with a wind speed of up to 2.9m/s (NW) measured on an electronic anemometer although slightly stronger winds were forecast. The temperature ranged between 5-6 degrees Celsius.

It is not considered that the weather conditions would have influenced the results.

The sound level meters used (with "outdoor kit") plus on-site calibrator can be found in Table 4 below. The meters calibrated correctly before and after the measurements; all instrumentation had been laboratory calibrated within the preceding 2 years.

Table 4

Instrument	Type	Serial No.	Calibration Cert. No.	Date of Due Calibration
Svan 977A	Sound Level Meter	69280	New - test date 23/02/2018	23/02/2020
ACO 7052E	Microphone	70160	New - test date 23/02/2018	23/02/2020
Svan SV12L	Preamp	71675	New - test date 23/02/2018	23/02/2020
Cirrus 511E	Calibrator	39816	Cirrus 248531	24/04/2021
Svan 977	Sound Level Meter	36870	1400 7353-1	09/09/2021
ACO 7052E	Microphone	61121	1400 7353-1	09/09/2021
Svan SV12L	Preamp	47576	1400 7353-1	09/09/2021

4.2 Results and Calculations (Road Noise)

Period measurements are shown below in Tables 5, 6, 7 and 8 below.

Table 5 - Monitoring Position 1 (Front – Road) dBA

Date & time	Duration	LAeq	LAFmax	LAFmin	L01	L10	L50	L90	L95
09/12/2019 10:00:01.800	01:00:00.000	72.1	91.4	37.0	82.1	76.9	63.1	47.4	45.2
09/12/2019 11:00:01.800	01:00:00.000	72.2	95.5	38.5	82.6	76.8	61.8	46.7	44.2
09/12/2019 12:00:01.800	01:00:00.000	72.1	95.9	41.2	82.3	76.7	62.4	48.7	47.0

Table 6 – Position 1 Octave Band Levels (Total Monitoring Period) dBA

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
65.0	67.4	69.8	64.2	54.5	44.2	33.9

Table 7 - Monitoring Position 2 (Rear – overlooking yard) dBA

Date & time	Duration	LAeq	LAFmax	LAFmin	L01	L10	L50	L90	L95
09/12/2019 10:10:48.400	01:00:00.000	61.2	78.3	39.8	69.5	65.2	57.7	47.8	45.8
09/12/2019 11:10:48.400	01:00:00.000	61.0	75.9	38.8	69.4	65.3	56.8	47.8	45.3
09/12/2019 12:10:48.400	01:00:00.000	61.1	77.9	39.8	69.4	65.0	57.8	50.3	47.6

Table 8 – Position 2 Octave Band Levels (Total Monitoring Period) dBA

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
58.4	53.8	54.7	58.3	54.5	45.2	36.5

In addition to the above, the maximum readings were recorded and the typical LAmax readings for passing vehicles at the front were noted to be around 83-85dB for the monitoring period (see figure 4). There is likely to be less (fewer commercial vehicles) as well as less frequent traffic passing the site at night. There were a few instances above the higher level, likely due to unusual vehicles such as agricultural vehicles or similar. For the rear position, with no clear view of the A523, the typical LAmax level was around 73-75dB (see Figure 5).

Figure 4

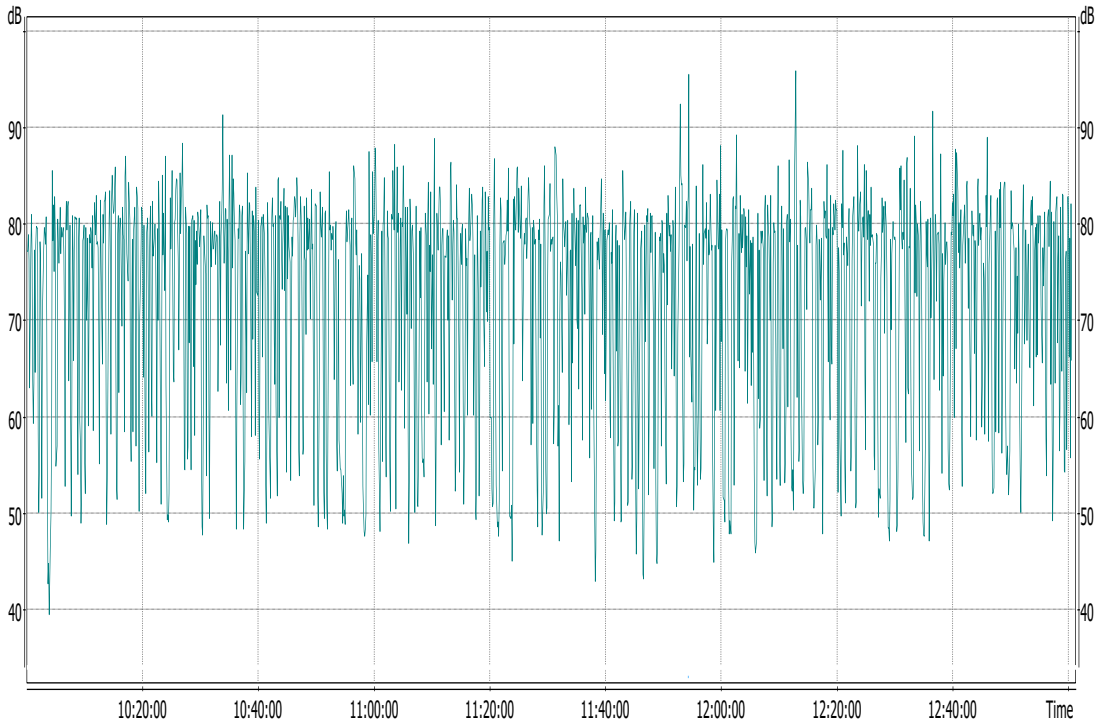
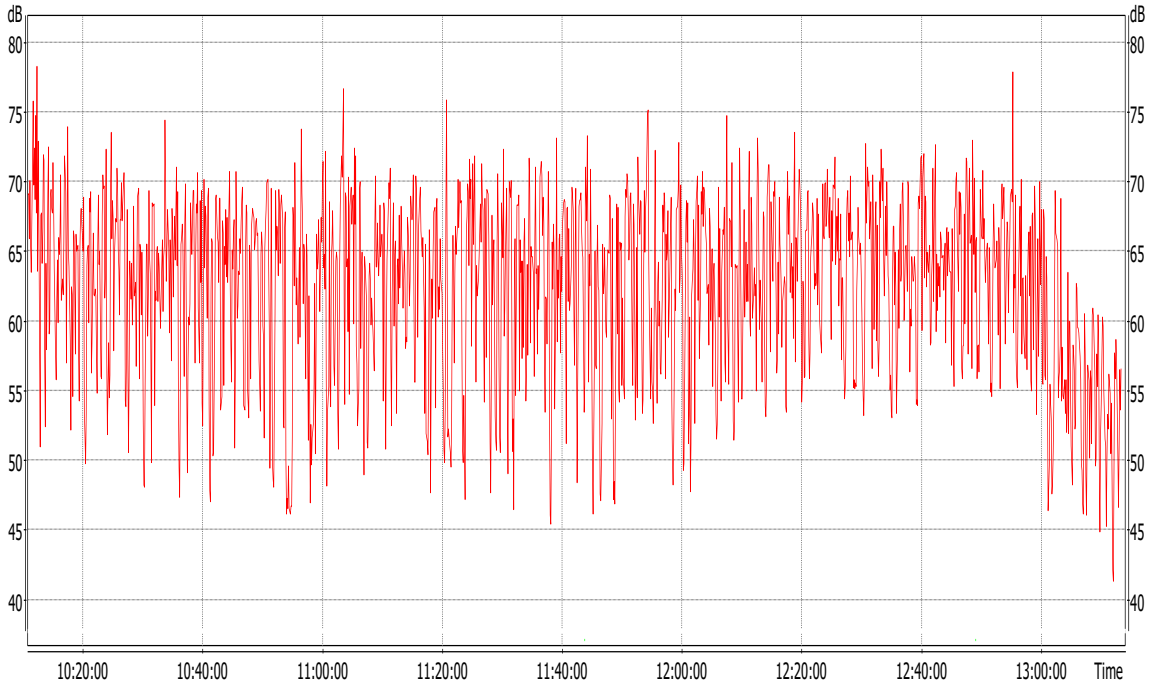


Figure 5



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 (as noted above), an empty lorry passing over bumps or potholes in a section of road, a car horn, emergency siren or a vehicle skidding.

4.3 Subjective Impressions

Road noise from the A523 was clearly audible and present throughout the monitoring period at position 1. At position 2, road noise was again the principal and dominant source of noise again, albeit diminished by the building itself which provides some screening. There were no clear sources of noise audible to the observer from the Will Nixon yard. It appears that this facility may be used for administration and storage only.

Therefore, road noise is considered the principal and dominant source overall and therefore an assessment to BS4142 is not considered necessary. Mitigating for road noise will of course mitigate for any occasional vehicle movement in the Will Nixon Yard or other occasional sounds during the daytime.

5.0 ASSESSMENT AND DISCUSSION

5.1 Road Traffic Noise (Position 1)

This assessment 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 = **69.7dB**

5.2 Nighttime Levels (23:00 to 07:00)

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

LAeq,8hr = **64.5dB**

5.3 Position 2

If we average the LAeq, 3-hour levels for the front and the rear we determine that there is approximately an 11dBA difference (noise reduction) [72.1 – 61.1 = 11dBA). This would result in daytime levels and night time levels as follows:

LAeq,16hr = **58.7dB**

LAeq,8hr = **53.5dB**

5.4 ProPG

ProPG is aimed principally at transport noise and new

developments. If we apply ProPG to this site, given the levels of noise present, this would place the site in the **high risk** category from ProPG as shown below. Therefore, Good Acoustic Design (GAD) is essential (see recommendations below).

Table 9 - ProPg

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

5.5 Internal Noise 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].

The following has been assumed from current plans to predict likely internal levels for the rooms as highlighted at the front or rear of the property:

- Reverberation time is 0.3s for bedrooms and 0.5 for living areas
- Volume for bedroom 1 = $25m^3$
- Window area (door) for bedroom 1 = $2.2m^2$
- Volume for bedroom 2 = $25m^3$
- Window area (door) for bedroom 2 = $2.2m^2$
- Volume for Kitchen / Dining room = $75m^3$
- Window area for kitchen / Dining room / Living Area = $12m^2$
- Wall Area = $10m^2$
- Existing block with cavity construction
- Tiled/slated roof, plasterboard ceiling, absorbing layer above the ceiling (e.g. mineral wool loft insulation)

Road noise will also reduce over distance to the rear of the property:

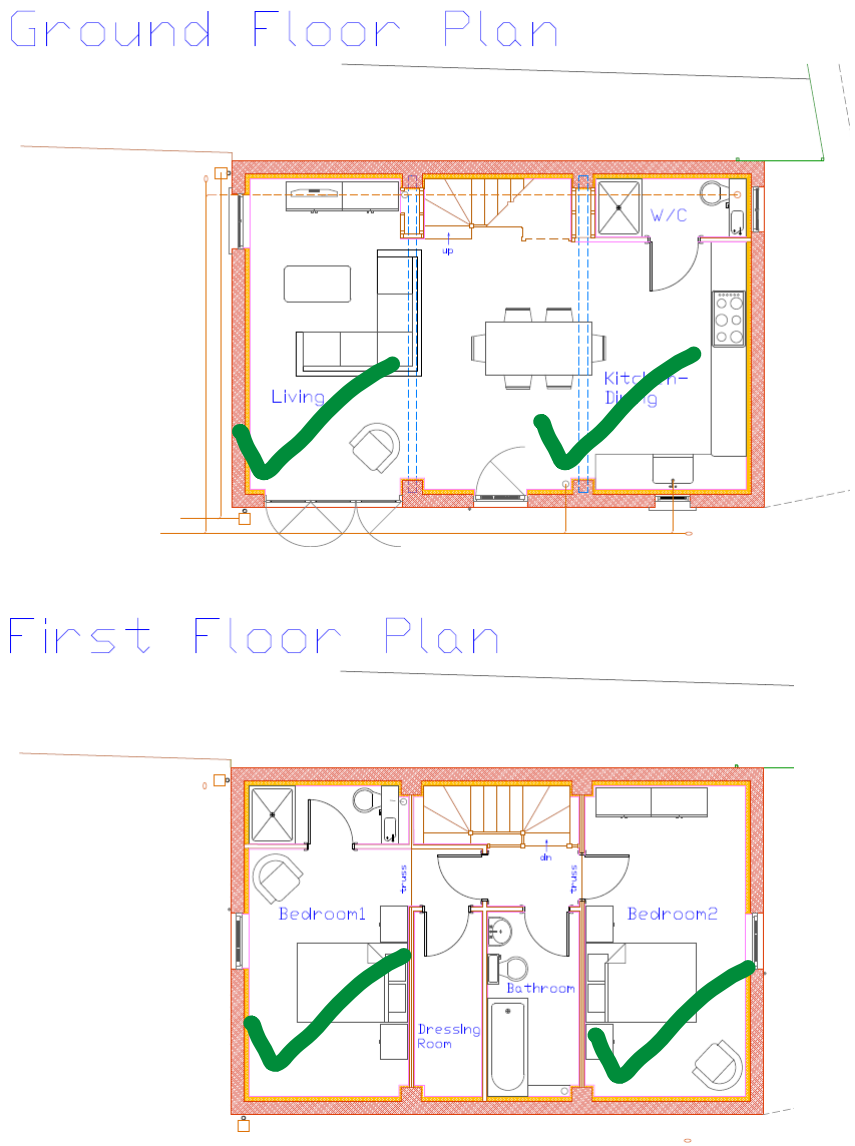
10LOG (monitoring distance from the road in metres / approximate distance from the road to bedroom 3 in metres) – line source

10Log (3 / 7)

= -3.6dBA which equates to daytime level of 66.1dBA and 60.9dBA over the nighttime period.

However, as a worst case, measured levels will be used for the internal noise calculation below as the ground floor open plan area has several windows around the building as well as glazed doors.

Figure 6 – Rooms used to estimate internal levels of noise dBA



5.6 Example Construction and Glazing

With (daytime) external levels of 69.7dBLAeq, 16 hours, to the front of the building, desirable internal levels

should be achievable using solid brickwork, brick/block cavity or brick clad timber frame, tiled/slated roof, 20kg/m^3 plasterboard ceiling, 100mm absorbing layer above the ceiling (e.g. mineral wool loft insulation) and timber boarding on top of ceiling joists; window and ventilation specification (as below). An example of suitable construction and glazing is also described below, based on the overall external octave band levels established during the monitoring period – this should achieve target levels.

5.7 ProPG

From ProPG, desirable internal levels are not likely to be met at night where windows are opened to cool bedrooms, allowing for 15dBA attenuation for a partially open window either at the front or rear [64.5 and 53.5 - 15=49.5 and 38.5dBA respectively]. Therefore, alternative purge ventilation is an option that must be considered for "good acoustic design".

5.8 Bedroom 1 (Predictions for internal Levels dBA)

For bedroom 1, facing the rear, it can be seen (Table 10) that the predicted internal daytime noise level of **18dB LAeq,16hr** using double glazing (10/12/6) as shown (or similar / better) with alternative mechanical ventilation (or PIV) would meet the daytime criteria of 35dB LAeq, 16hr from BS8223:2014 for bedrooms.

Table 10 (Bedroom 1)

BS EN 12354-Calcs	Use	Volume	Volume	25.0				
Version 4.3	length						Building Atten dBA (58.7 - 18.5)	40
© 2018 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 & Lin)		58.4	53.8	54.7	58.3	54.5	60.9
	Adjustment to Given Level if required							58.7
	External Spectrum Adjusted for Level		56.2	51.6	52.5	56.1	52.3	58.7
Wall		Area m2	Element Sound Reduction Index [SRI]					Contrib
Brick/block/cavity		10.0	41	45	45	54	58	9.6
Drs/Wndws								
10/12/6_double_glazing		2.2	26	27	34	40	38	17.6
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
Vent Dn,e		# Vents						
Greenwood MA3051 Acoustic Wall vent		1.0	47	46	49	56	66	6.5
								dBA
	Internal SPL/dBLin		26.1	20.3	15.4	12.4	9.6	18

Given the reduction of -5.2dBA [58.7-53.5 = 5.2] for nighttime noise levels then the desirable internal level of 30dB LAeq, 8hr from BS8223:2014 for bedrooms would also be met at **12.8dBA** [18–5.2 = 19.8dB].

LAmax levels are typically around 73-75dB (see figure 5). Given the predicted difference between external and internal levels of 40dB this would equate to internal levels of **33-35dB LAmax** which meets the LAmax criteria of 45dB from BS8233 / ProPG.

5.9 Bedroom 2 (Predictions for internal Levels dBA)

For bedroom 2 it can be seen (Table 11) that the predicted internal daytime noise level of **27dB LAeq,16hr** with Pilkington glazing as shown (or similar) with alternative mechanical ventilation (or PIV) would meet the daytime criteria of 35dB LAeq, 16hr from BS8223:2014 for bedrooms.

Table 11 (Bedroom 2)

BS EN 12354-Calcs	**Use**	Volume	**Volume**	25.0				
Version 4.3	**length**						**Building Atten dBA (69.7 - 27.1)**	**43**
© 2018 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 & Lin)		65.0	67.4	69.8	64.2	54.5	**69.2**
	Adjustment to Given Level if required							69.7
	External Spectrum Adjusted for Level		**65.5**	**67.9**	**70.3**	**64.7**	**55.0**	**69.7**
Wall		**Area m2**	**Element Sound Reduction Index [SRI]**					**Contrib**
Brick/block/cavity		10.0	**41**	**45**	**45**	**54**	**58**	**24.9**
Drs/Wndws								
10.8 (24) 16.8 Pilkingtons		2.2	**35**	**41**	**48**	**53**	**55**	**17.9**
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**
Vent Dn,e		**# Vents**						
Greenwood MA3051 Acoustic Wall vent		1.0	**47**	**46**	**49**	**56**	**66**	**21.5**
								dBA
	Internal SPL/dBLin		**29.5**	**28.3**	**28.8**	**15.4**	**0.7**	**27**

Given the reduction of -5.2dBA [69.7-64.5 = 5.2] for nighttime noise levels then the desirable internal level of 30dB LAeq, 8hr from BS8223:2014 for bedrooms would also be met at **21.8dBA** [27–5.2 = 21.8dB].

LAmax levels are typically around 83-85dB (see figure 4). Given the predicted difference between external and internal levels of 43dB this would equate to internal levels of **40-42dB LAmax** which meets the LAmax criteria of 45dB from BS8233 / ProPG.

5.10 Kitchen / Living / Dining Area (Predictions for internal Levels dBA)

For the kitchen, it can be seen (Table 12) that the predicted internal daytime noise level of **27dB LAeq,16hr** with Pilkington glazing as shown (or similar) and alternative mechanical ventilation (or PIV) would meet the daytime criteria of 40dB LAeq, 16hr from BS8223:2014 for living areas.

Table 12 (Kitchen / Living Room)

BS EN 12354-Calcs	Use	Volume	Volume	75.0				
Version 4.3	length					Building Atten dBA (69.7 - 27.1)		43
© 2018 Martec Environmental Consultants Ltd & Acute Acoustics Ltd	width		RT	0.5				
	height		Octave Band Centre Frequency [Hz]					dBA
			125	250	500	1k	2k	
External Spectrum Leq (Free Field & Lin)			65.0	67.4	69.8	64.2	54.5	69.2
Adjustment to Given Level if required								69.7
External Spectrum Adjusted for Level			65.5	67.9	70.3	64.7	55.0	69.7
Wall		**Area m2**	Element Sound Reduction Index [SRI]					Contrib
Brick/block/cavity		10.0	41	45	45	54	58	22.3
Drs/Wndws								
10.8 (24) 16.8 Pilkingtons		12.0	35	41	48	53	55	22.8
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
Vent Dn,e		**# Vents**						
Greenwood MA3051 Acoustic Wall vent		2.0	47	46	49	56	66	22.0
								dBA
	Internal SPL/dBLin		31.6	29.5	28.2	15.8	1.8	27

5.11 External Areas

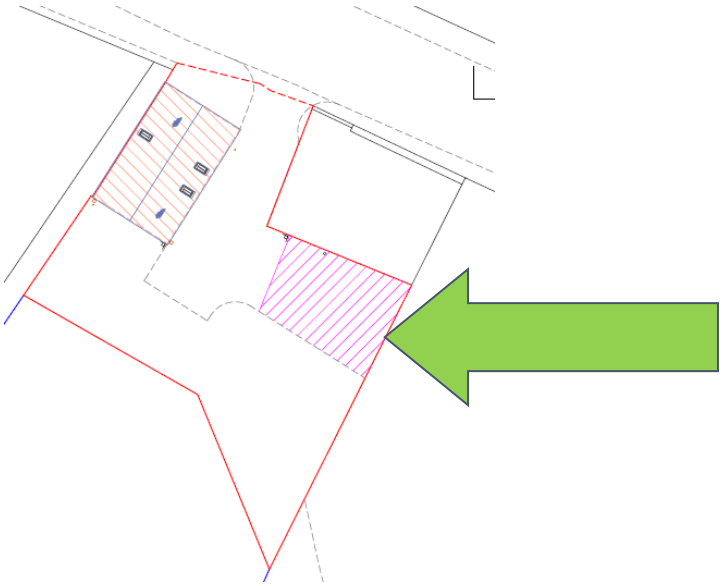
Daytime external levels LAeq, 16 hours have been calculated at 69.7dB. There are no plans for a "garden" as such at this property, the land will instead remain "agricultural". However, as shown in the image below, the hatched area will likely serve as an amenity space. There will therefore be a reduction in road noise over this additional distance (from the monitoring position).

10LOG (monitoring distance from the road in metres / approximate distance from the road to the garden in metres) – line source

10Log (3 / 11)

= -5.6dBA which equates to daytime level of 64.1dBA.

Figure 7



Therefore, to achieve the desirable range for outdoor levels of 50-55dBA to ensure that annoyance is avoided from BS8233, an additional 9.1dBA minimum attenuation is necessary.

A closed boarded fence will assist with this when constructed close to the amenity space. As the table below suggests, 9.9dBA of sound attenuation is possible with a fence of 1.8m located, also as shown.

Table 13 – Barrier

Location		Garden
Ht of Ground at Receiver AoD		0
Ht of Receiver Abv local grnd		1.2
Dist of Receiver		13
Angle of View		180
Proportion of Soft Ground		0
Height of Propagation Path		0.95
Barrier 1	Ht of Ground at Barrier	0
	Ht of Barrier Abv local grnd	1.8
	Dist of Barrier top from source	11
Barrier 1	Barrier Attenuation	-9.9

This should ensure that the lower level of the desirable range as a minimum will be achieved in sections of the garden.

Figure 8 – Suggested location of fencing



6.0 CONCLUSIONS AND RECOMMENDATIONS

The above demonstrates that with considered specification appropriate noise levels can be met with reference to BS8233: 2014 and ProPG.

The following noise control measures are recommended:

- For habitable rooms with windows which have a view of the road, windows should be fitted with Pilkington glazing (10.8 (24) 16.8 or better) and alternative ventilation to ensure that rooms can be cooled without the need to open windows in the Summer months.

- Alternative ventilation can include Mechanical Extract Ventilation (MEV) or Positive Input Ventilation (PIV) systems which 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
- https://www.envirovent.com/sectors/new-build-developers/
- https://www.greenwood.co.uk/mev

- For all other rooms with windows overlooking the rear, i.e. screened by the building from the road, double

glazing (10/12/6 or better) with acoustic trickle ventilation (or alternative ventilation throughout the house) should suffice.

- 1.8m close-boarded or acoustic fencing is recommended as shown to help meet target levels for amenity spaces.

Table 14: Required Element Performance or similar and approved [dB]

Element	Unit	Octave Band Centre Frequency [Hz]				
		125	250	500	1k	2k
Glazing (View of Road)	SRI	35	41	48	53	55
Glazing (Other)	SRI	26	27	34	40	38

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 17 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 Monitoring Location



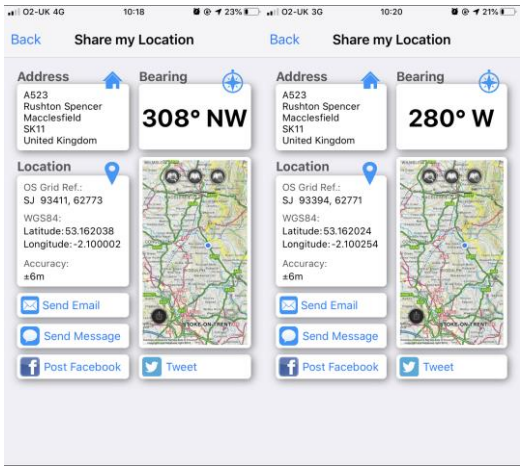
Front Position (Road)



Side elevation



Mounted equipment overlooking yard



Grid references

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

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