


Bloomhall
Land off Comberton Road, Toft
Technical Report

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1 INTRODUCTION

MLM Acoustics has been commissioned by Bloomhall to undertake an assessment of noise affecting proposed residential units on land off Comberton Road, Toft.

The suitability of the site for residential development has been assessed based on the current development proposals and the measured noise levels. Where predicted levels indicate that noise may be a determining factor in the granting of planning permission, mitigation measures have been considered to ensure satisfactory conditions are met.

The assessment is based on the findings of an on-site noise survey, tailored to consider all noise sources affecting the site.

Whilst every effort has been made to ensure that this report is easily understood, it is technical in nature; a glossary of terms in Appendix A is included to assist the reader.

2 POLICY AND ASSESSMENT METHODOLOGY

National Planning Policy Framework

National Planning Policy Framework (NPPF)¹ published on March 27th 2012 sets out the Government's economic, environmental and social planning policies for England. It summarises in a single document all previous national planning policy advice. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.

The NPPF sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Under Section 11; Conserving and enhancing the natural environment, the following is stated:

The planning system should contribute to and enhance the natural and local environment by:

- *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.*

The document goes on to state:

Planning policies and decisions should aim to:

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

As stated above, this document makes reference to avoiding noise generation from new developments that would adversely impact on health and quality of life. It effectively supersedes PPG24, but does not set absolute criteria.

Planning Practice Guidance – Noise

The National Planning Practice Guidance (NPPG²) has been revised and updated to be easily accessible and available online.

¹ Department for Communities and Local Government, March 2012. National Planning Policy Framework. HMSO.

² National Planning Practice Guidance, Department for Communities and Local Government (DCLG), March 2014
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The Noise Guidance advises on how planning can manage potential noise impacts in new development. It sets out when noise is relevant to planning and outlines the following Observed Effect Levels to determine the noise impact:

- *Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.*
- *Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*
- *No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.*

The document recognises the subjective relationship between noise levels and the impact on those affected, and advises on factors which may influence on whether noise could be a concern.

British Standard 8233

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guidance values, as detailed below in Table 1.

TABLE 1: BS8233:2014 INDOOR AMBIENT NOISE LEVELS			
Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS8233:2014 goes on to suggest that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

With regard to maximum noise levels, the standard identifies that regular individual noise events (such as passing trains or scheduled aircraft etc) can cause sleep disturbance. The standard does not provide a guideline design target, but simply goes on to suggest that a guideline value may be set in terms of SEL or $L_{Amax,F}$, depending upon the character and number of events per night. It goes on to suggest that more sporadic noise events could require separate values.

In respect of external noise levels, the guidance in BS8233:2014 suggests that *“it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments”*. Accordingly, the design criteria adopted for this assessment will ensure that noise within external amenity areas will be adequately controlled.

BS8233:2014 provides a much more detailed narrative on noise levels in external amenity areas and acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within these guideline values.

In respect of gardens and patios, BS8233:2014 states; *“however, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited”*.

In respect of balconies, roof gardens and terraces, BS8233:2014 states, *“Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses; however, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space”*.

It is clear from the narrative of BS8233:2014, that proposed development within noisy environments should be designed to ensure that the recommended internal design standards are achieved, and that noise levels in external amenity areas are designed to effectively control and reduce noise levels, although it acknowledges that in certain circumstance meeting the external design recommendations may not be feasible, or necessary, especially where the provision of such spaces is desirable for other technical, planning or policy reasons.

The following internal noise level criteria have been adopted for this assessment, which will ensure no adverse impact:

Living Rooms	-	07:00–23:00 hours	-	35 dB L_{Aeq}
Bedrooms	-	07:00–23:00 hours	-	35 dB L_{Aeq}
		23:00–07:00 hours	-	30 dB L_{Aeq} and 45 dB L_{Amax}
Dining Rooms	-	07:00–23:00 hours	-	40 dB L_{Aeq}
External Living Areas	-	07:00–23:00 hours	-	55 dB L_{Aeq}

British Standard BS 4142

BS 4142 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS 4142 for assessing the effect of sound on residential receptors is to compare the measured or predicted noise level from the source in question, the $L_{Aeq,Tr}$ ‘specific noise level’, immediately outside the dwelling with the $L_{A90,T}$ background noise level.

Where the noise contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific noise level to obtain the $L_{Ar,Tr}$ ‘rating noise level’. A correction to include the consideration of a level of uncertainty in noise measurements, data and calculations can also be applied when necessary.

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BS 4142 states: "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". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:

- "Typically, the greater this difference, the greater the magnitude of the impact."
- "A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."
- "A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."
- "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."

For the daytime, the assessment is carried out over a reference time period of 1-hour, but at night-time it is carried out over a 15-minute period. The periods associated with day or night, for the purposes of the Standard, are considered to be 07:00 to 23:00 and 23:00 to 07:00, respectively.

3 SITE DESCRIPTION

It is proposed to develop the site for residential purposes, comprising two traditional units.

The site is bound to the south by Comberton Road; to the north by a skip hire/aggregates recycling facility; to the east by open fields and to the west by existing dwellings served via Hardwick Road. The site is affected by noise arising from road traffic using Comberton Road, to the south and activity within the skip hire/aggregates facility, to the north.

The proposed development is shown in the context of the locality on Figure 1.

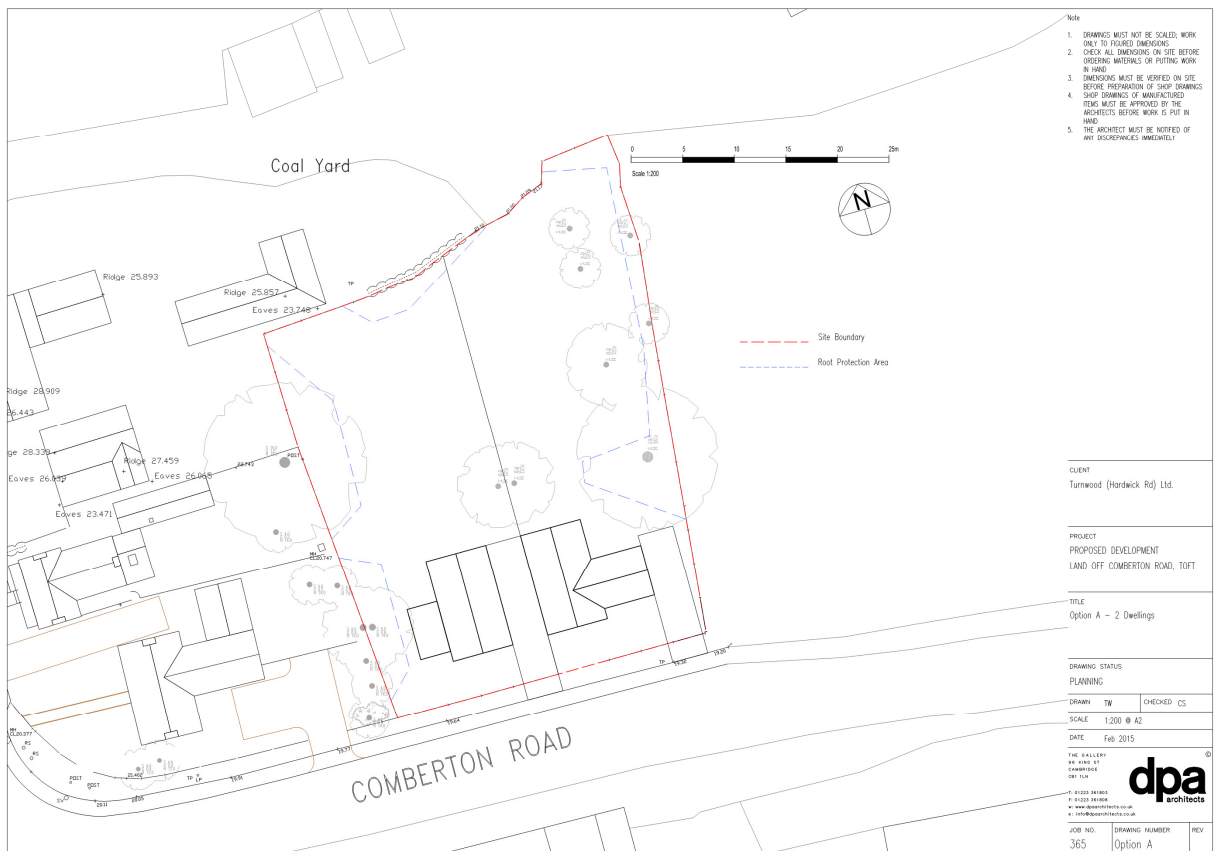


FIGURE 1: SITE LOCATION PLAN

The activities within the area of the adjacent commercial premises are split into two distinct zones; with the area to the east used for the loading, unloading and sorting of aggregates and the area to the west, immediately adjacent to the application boundary, used primarily for skip storage. Consequently, the area of the commercial premises immediately adjacent to the application site experiences a much lower intensity of use than the remainder of the site, with a corresponding reduction in noise generation. The activities are summarised on Figure 2.

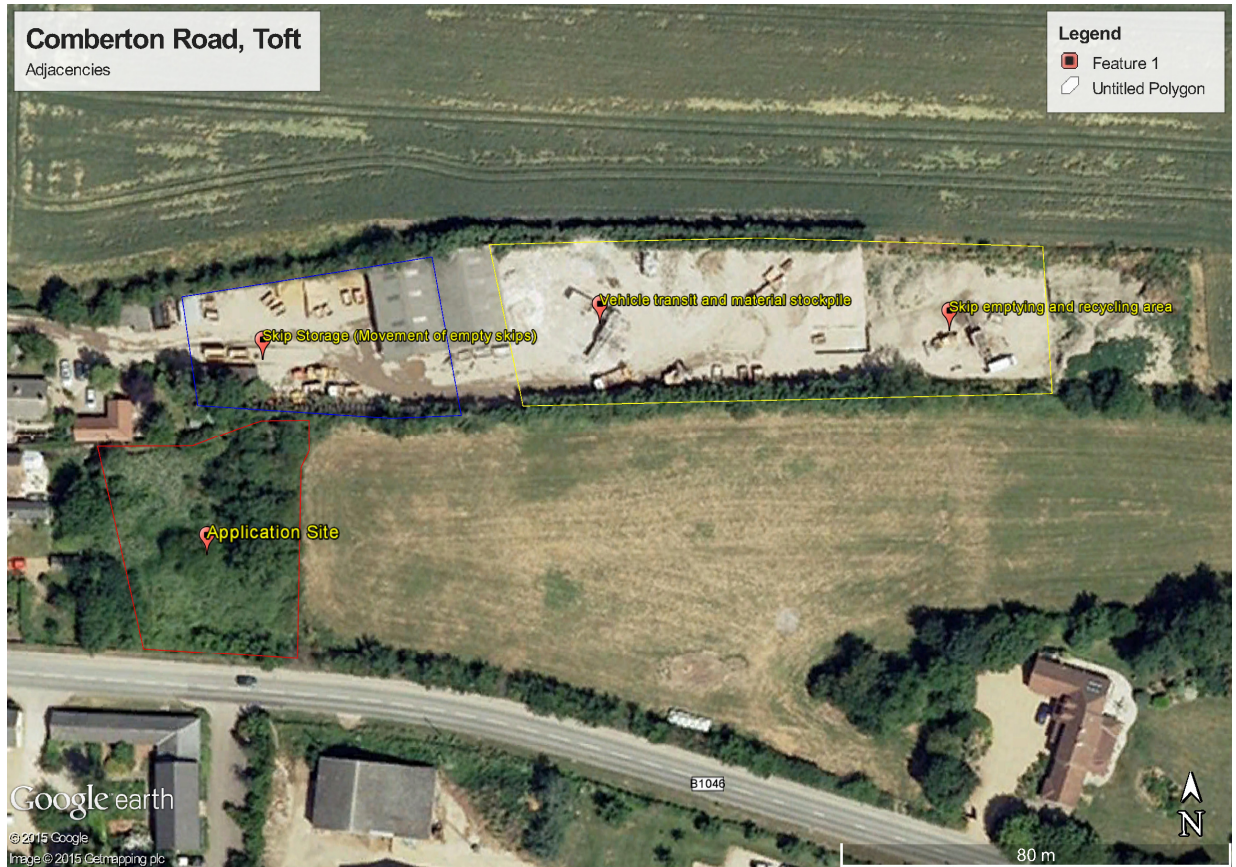


FIGURE 2: DETAILS OF ADJACENT COMMERCIAL ACTIVITIES

4 NOISE MEASUREMENTS

The prevailing noise conditions in the area have been determined by an environmental noise survey. The measurements were undertaken over a typical weekday period between Wednesday 18th and Thursday 19th March 2015.

Measurements details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445³.

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672⁴. A full inventory of this equipment is shown in Table 2.

Item	Make & Model	Serial Number	Calibration certificate Number	Date of Expiration of Calibration
Sound Level Meter	01dB Solo	61280	1306274	18/06/15
Preamplifier	01dB Pre 21	14175	1306274	18/06/15
Microphone	Gras	167948	1306274	18/06/15
Sound Level Meter (Cambridge)	Rion NL-52	00620900	1502082/83	05/03/17
Preamplifier	Rion NH-25	31972	1502082/83	05/03/17
Microphone	Rion UC-59	03797	1502082/83	05/03/17
Sound Level Meter	Rion NL-52	00620957	1412600	16/12/16
Preamplifier	Rion NH-25	20998	1412600	16/12/16
Microphone	Rion UC-59	03875	1412600	16/12/16
Calibrator	Rion NC-74	35105086	1405283	28/05/15

The noise measurement equipment used during the surveys was calibrated at the start and end of each measurement period. The calibrator used had been calibrated by an accredited calibration laboratory within the twelve months preceding the

³ British Standard 7445: 2003: Description and measurement of environmental noise. BSI

⁴ British Standard 61672: 2003: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

measurements. No significant drift in calibration was found to have occurred on any sound level meter.

Each microphone was fitted with a protective windshield for the measurements. The weather conditions during the survey were conducive to noise measurement, it being dry with wind speeds of substantially less than 5 ms⁻¹.

Figure 3, below, identifies the noise measurement locations used in this assessment.

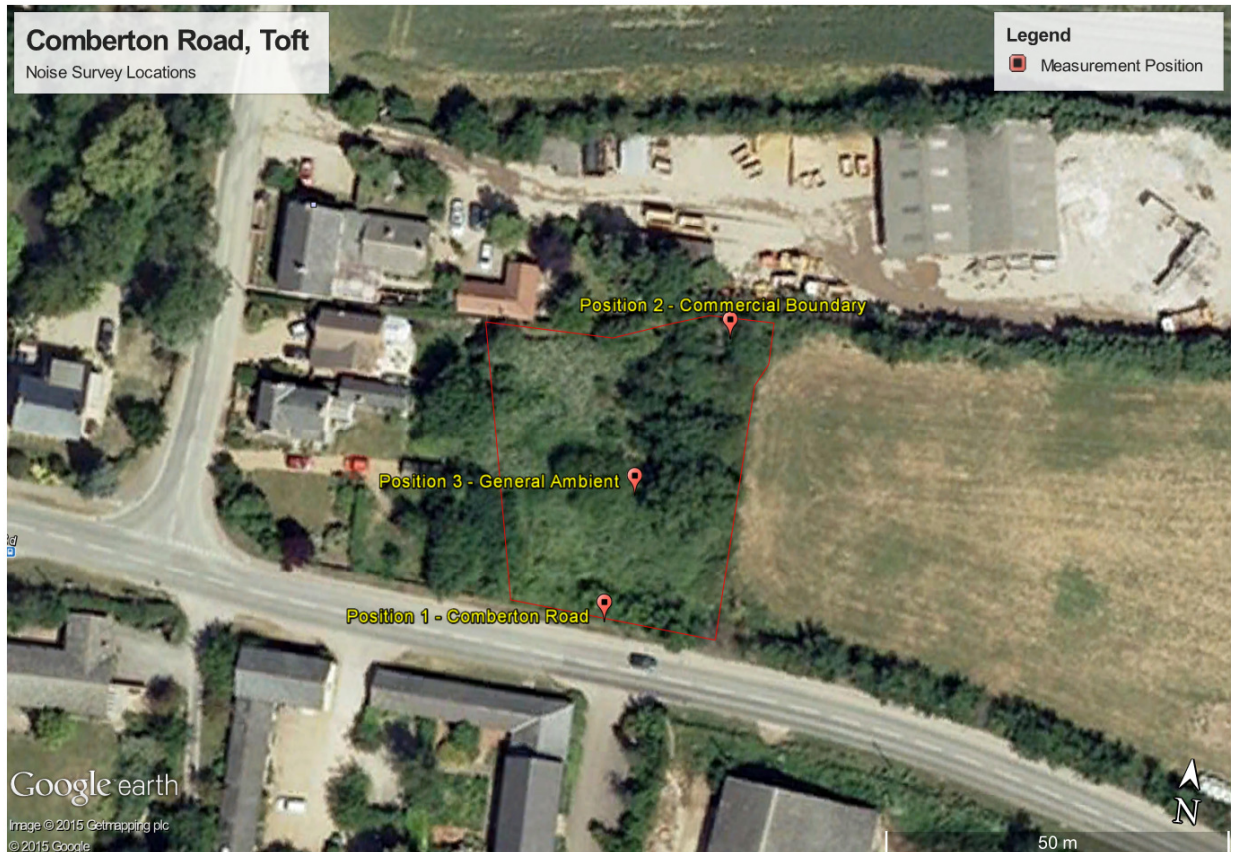


FIGURE 3: MEASUREMENT LOCATIONS

Attended and part-attended noise measurements were carried out between Wednesday 18th March and Thursday 19th March 2015, in order to gain a representative sample of daytime and night-time noise levels at the site. Three noise measurement positions were chosen, which are described below and identified in Figure 3.

A continuous site presence was maintained throughout the 13:00 to 17:30 period of 18th March, enabling detailed acoustic observations of the sources affecting the site. Some construction work was underway on a nearby project, the acoustic contributions of which were noted and have been removed from the data.

- Position 1 – a 24-hour free-field measurement on the highway boundary to Comberton Road, intended to provide details of noise exposure arising from road traffic using Comberton Road. The microphone was located at a distance of 3 metres from the northern carriageway edge and at a height of 2 metres above ground. The dominant source of noise at this location was that arising from road traffic using Comberton Road; however, frequent contributions

were audible, arising from the recycling area of the adjacent commercial premises;

- Position 2 – a 24-hour free-field measurement on the boundary with the commercial operation to the north. The microphone was located at a height of 1.5 metres above ground, with an unobstructed line of sight into the commercial site. The dominant source of noise at this location was noted to be lorry movements within the skip storage area of the commercial site, with audible contributions from road traffic using both Comberton Road and Hardwick Road; and
- Position 3 – a daytime-only free-field measurement, located in the centre of the proposed application site, intended to provide an ambient noise level within the rear garden area of the proposed dwellings. The microphone was located at a height of 1.5 metres above ground. The dominant source of noise at this location was noted to be lorry movements within the skip storage area of the commercial site, with audible contributions from road traffic using both Comberton Road and Hardwick Road, plus occasional audible contributions arising from recycling activities at the eastern end of the commercial site.

The key elements of the noise survey are presented in Tables 3 and 4 below, with full survey output presented under Appendix B.

TABLE 3: SUMMARY OF NOISE MEASUREMENT RESULTS					
Position	Period	Noise Level, dB			
		L_{Aeq,T}	L_{A90,T}	L_{A10,T}	L_{AFMax}
1	Daytime (07:00-23:00)	67.9	48.3	70.7	85.0
	Night-time (23:00-07:00)	55.3	30.5	40.0	79.4
2	Daytime – Site Active (13:20-17:20)	55.8	*47.0	56.4	70.5
	Daytime – Site Inactive (17:30-19:00)	51.4	*43.3	53.6	67.2
	Night-time (23:00-07:00)	48.6	30.2	39.4	63.1
3	Daytime – Site Active (13:20-17:20)	53.5	*47.9	56.4	69.1
	Daytime – Site Inactive (13:05-13:20 lunch break)	52.5	42.8	56.2	67.0
*denotes typical measured 15-minute result					

TABLE 4: SUMMARY OF SPECTRAL NOISE MEASUREMENT RESULTS												
Period	Measured Free-Field Noise Level – $L_{eq,T}$ - dB											
	dBA	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
Position 1												
Day	67.9	61.8	63.8	69.1	62.2	60.5	61.5	65.8	60.2	50.5	42.9	32.5
Night	55.3	49.9	55.9	55.9	49.5	47.9	47.9	48.7	53.1	47.5	40.5	33.9
Position 2												
Day*	55.8	57.5	63.4	65.7	57.9	53.6	51.1	51.0	49.0	45.1	37.6	28.2
Period	Measured Free-Field Noise Level – L_{FMax} - dB											
	dBA	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
Position 1												
Night	79.4	71.8	76.5	83.2	75.3	72.3	73.4	78.1	72.1	64.6	58.2	43.5
*denotes results from operational period of commercial facility only												

5 ASSESSMENT OF RESIDENTIAL AMENITY

Internal Amenity

The key significance criteria adopted for this assessment are those contained within BS 8233: 2014, as summarised earlier in this report.

In order to assess the acoustic performance of the proposed dwellings, it is appropriate in the first instance to explore the level of protection that will be afforded by the performance of the glazing and ventilation elements in combination.

The glazing and ventilation elements are typically the weakest acoustic link in the construction of a building facade. Therefore, in order to assess the acoustic performance of the proposed dwellings, it is appropriate in the first instance to explore the level of protection that will be afforded by the performance of the glazing elements.

Windows do not reduce noise equally across the entire frequency spectrum, so the frequency content of the sound will influence the overall sound reduction performance of a given window and by extension, the resulting noise levels within the receiving room.

Many glazing manufacturers test their products under laboratory conditions using a typical road traffic noise frequency spectrum source. The resultant measured noise attenuation, in dB, gives a very useful guide to in-situ sound reduction performance of the window for situations where road traffic noise dominates. This performance index is known as the R_{TRA} .

For a road traffic noise spectrum (R_{TRA}), standard thermal double glazing will typically provide a façade sound insulation performance of 33 dB(A), which for free-field noise levels as predicted in this case would be 30 dB(A). As an example of a glazing unit that could achieve the above performance, the glazing manufacturer SG states that its 4/12/4 double glazed window unit has an R_{TRA} of 30dB. The 4/12/4 notation refers to a glazing unit comprising a 4mm pane of glass and a 4mm pane of glass, separated by a 12mm air gap.

The Building Regulations recommend that habitable rooms in dwellings have background ventilation. Internal noise levels should be considered in the context of room ventilation requirements. In this instance, the target internal noise levels will only be achieved when windows are closed. An alternative means of ventilation will therefore be required to comply with the requirements of the Building Regulations Approved Document F.

In order to achieve the target daytime and night-time internal noise levels, it is necessary to determine the minimum acoustic performance requirements of both the glazing and ventilation system. It is assumed that the default choice of glazing for the habitable rooms of the proposed development will be double glazing and the default choice for ventilation will be acoustically attenuated through window slot ventilators.

In order to provide a robust assessment and to comply with the design requirement to provide BS8233: 2014-compliant internal noise levels for both daytime and night-time periods, 35 dB(A) has been adopted as the design target for the proposed development during the day and 30 dB(A) at night. To determine the glazing and

ventilation requirements in order to provide an adequate level of protection against external noise intrusion, representative $L_{Aeq,16hour}$ daytime and $L_{Aeq,8hour}$ night-time noise levels have been considered at the façade of the proposed dwellings that are likely to be exposed to the highest levels of noise.

The derivation of the noise statistics used in the determination of façade insulation requirements has been undertaken on the following basis:

- South façade – daytime and night-time noise levels from noise measurement position 1, adjusted for distance from source, with the noise measurement position being at 3 metres from the carriageway edge and the dwelling façade being proposed at 7 metres; and
- North façade – worst case daytime noise levels from noise measurement position 2, not adjusted for distance or the screening from road traffic noise that will be introduced via the built form of the dwellings. This is therefore considered a robust worst case, as it considers absolute noise levels, which are higher than are likely to actually be experienced in the future.

Table 5 sets out the broadband sound reductions required for both the southern and northern facades of the proposed dwellings, on the basis of the above assumptions.

TABLE 5: SOUND REDUCTION PERFORMANCE REQUIRED							
Position	Period	Calculated Noise Level, dB		Target Internal Noise Level, dB		Required Sound Reduction Performance, R_{TRA} dB	
		$L_{Aeq,T}$	L_{AFmax}	$L_{Aeq,T}$	L_{AFmax}	$L_{Aeq,T}$	L_{AFmax}
South Facade	Day – 0700-2300	66.4	-	35.0	-	31.4	-
	Night – 2300-0700	53.8	72.8	30.0	45.0	23.8	27.8
North Facade	Day – 0700-2300	55.8	-	35.0	-	20.8	-

Table 5 identifies that the sound reduction performance requirements for the proposed development are driven by meeting the daytime target $L_{Aeq,T}$ internal noise level of 35 dB for the southern façade, and that acoustic mitigation will not be required on the northern facade.

As such, in accordance with the guidance presented above, it is likely that BS8233: 2014-compliant internal noise levels would be provided for the northern façade of the proposed development with well sealed standard thermal double glazing, but a higher level of treatment will be required in order to mitigate the southern façade against road traffic noise.

Please note, that sound reduction performances detailed in Table 5 apply to habitable rooms, such as living rooms and bedrooms, only. For non-habitable rooms, such as kitchens, bathrooms, stairways, halls, landings etc, single glazing will provide an

appropriate level of sound insulation, although such glazing is unlikely to be utilised for thermal efficiency reasons.

Based on the assumption that up to 25% of each habitable room facade will be glazed, calculations have been carried out to determine the required acoustic performances for the wall, glazing and ventilation elements of habitable rooms, to provide BS 8233-compliant internal noise levels during both the day and the night. These performance requirements are presented in Table 6.

TABLE 6: MINIMUM PERFORMANCE FOR GLAZING AND VENTILATORS								
Façade Component	Frequency, Hz - dB							
	63	125	250	500	1000	2000	4000	8000
Wall	Sound Reduction Performance, R_w dB							
Brick/Block Cavity Wall (BS8233)	36	41	45	45	54	58	58	58
Glazing	Sound Reduction Performance, R_w - dB							
SGG 4/12/4mm	17	22	20	26	36	39	31	31
Ventilation	Sound Reduction Performance, R_w - dB							
Generic Passive In-Wall Attenuated Ventilator	30	35	34	33	38	49	49	49

Other units may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems; however, the above analysis demonstrates that the proposed minimum acoustic performance specification for the construction of the proposed development will be sufficient to provide 'good' internal noise.

There is no stipulated requirement for these internal levels to be met with windows open for ventilation, rather that these levels have to be met in conjunction with appropriate rates of ventilation, compliant with Part F of the UK Building Regulations.

BS 4142 Assessment

BS 4142 has been historically intended for the assessment of impact of industrial noise on people already living in the vicinity, so has been inappropriate for use in assessing the impact of industrial noise on the future occupants of a housing development. BS 4142: 2014; however, has now removed this exclusion, so an assessment of likely noise levels in the context of BS 4142 is set out here.

BS 4142: 2014 does assert the importance of context; the important factors of which, in this instance are considered to be:

- The receptors are new and occupiers would be taking up ownership and/or residency in the knowledge of the character of the area and its existing

sources of noise and will not have a pre-existing expectation upon the noise climate;

- The noise levels incident upon the north and north facing areas of the proposed residential plots are not particularly high, but that noise is partially or predominantly characterised by noise of a commercial nature; and
- Considering the above factors in combination, the acoustic sensitivity of the receptor to the existing sources of commercial noise is reduced.

This element of the assessment is therefore considered to be complementary to the core part of the assessment; being the façade insulation requirements. This part of the assessment is therefore presented in order to identify the acoustic contributions of the adjacent commercial activities in the context of the overall noise levels.

Although BS 4142: 2014 relates to the impacts at a dwelling façade, it is considered appropriate in this instance, to use it to contextualise noise levels within the rear garden (external living/amenity) space of the dwellings, as this is where residents will actually experience exposure to the adjacent noise sources. The assessment therefore considers the daytime (as the site only operates during this period) at both the northern extent (foot of the proposed gardens) and central area, close to the proposed rear facades of the proposed dwellings.

The ambient and residual noise levels have been taken from the operational and non-operational L_{Aeq} statistics, respectively from Positions 2 and 3, which have been reduced to specific noise levels accordingly.

In terms of feature corrections; the site is rural, with an anticipated expectation of the future occupiers of typical rural sound sources, similar to those generated by agriculture. The noise generation from the commercial site largely comprises the following:

- On-site vehicle movements, comprising HGVs entering and leaving the site. This source, although intermittent, is considered reasonably typical of a rural environment characterised by road traffic noise, although the location of the activity away from a public highway would imply a level of intermittency;
- Occasional loading and unloading of skips, which would be considered both intermittent and impulsive; and
- At this location, the more distant sounds of mechanical processing plant within the more distal recycling area of the site.

The BS 4142 assessment, taking account of the above factors, is presented in Table 7.

TABLE 7: BS 4142 ASSESSMENT - DAYTIME		
Northern Extent of Proposed Gardens (Northern Boundary)		
Predicted Specific Noise Level	$L_{Aeq} = 53.8 \text{ dB}$	<i>Cumulative noise level from cooler fans and AHU</i>
Acoustic Correction	+ 6 dB	<i>No tonal penalty. +3 dB for Impulsivity. +3 dB for Intermittency.</i>
Rating Level	$L_{Ar,Tr} = 59.8 \text{ dB}$	$L_{Aeq} + \text{Correction}$
Background Level	$LA_{90,15\text{-Min}} = 43.3 \text{ dB}$	<i>Typical 15-minute period during the day.</i>
Excess of rating level over background noise level	+16.5 dB	<i>Indication of significant adverse impact (dependant upon context)</i>
Rear of Proposed Dwellings (Southern Area of Rear Gardens)		
Predicted Specific Noise Level	$L_{Aeq} = 46.6 \text{ dB}$	<i>Cumulative noise level from cooler fans and AHU</i>
Acoustic Correction	+ 6 dB	<i>No tonal penalty. +3 dB for Impulsivity. +3 dB for Intermittency.</i>
Rating Level	$L_{Ar,Tr} = 52.6 \text{ dB}$	$L_{Aeq} + \text{Correction}$
Background Level	$LA_{90,15\text{min}} = 42.8 \text{ dB}$	<i>Typical 15-minute period during the day.</i>
Excess of rating level over background noise level	+9.8 dB	<i>Indication of adverse to significant adverse impact (dependant upon context)</i>

As can be seen from Table 7, the assessment concludes that the contribution of commercial noise at the site is a significant component. BS 4142: 2014 does; however state within Section/Clause 11 that the determination of significance is dependent upon the context. In this instance, there are key factors that dictate the context, which are described earlier in this section.

As the assessment is based on definitive on-site measurements, with defined source on and source off periods, no adjustments for uncertainty are considered necessary.

Considering the above factors, it is considered that while commercial noise is likely to be significant at the closest development façade and a key component of the soundscape, the actual impact is not as significant as the BS 4142 assessment would imply.

Nevertheless, it is acknowledged that this development is unlikely to be taken forward in the absence of mitigation, which is discussed in the next section.

6 MITIGATION & RESIDUAL EFFECTS

Boundary Treatment

In light of the dominance of commercial noise within parts of the rear garden spaces of the proposed dwellings, rather than the overall level of noise, a system of noise barriers is proposed, which should significantly reduce the levels of received noise. These measures comprise a combination of 2.0-metre and 2.4-metre high acoustic barriers along parts of the residential boundary, as set out in Figure 4.

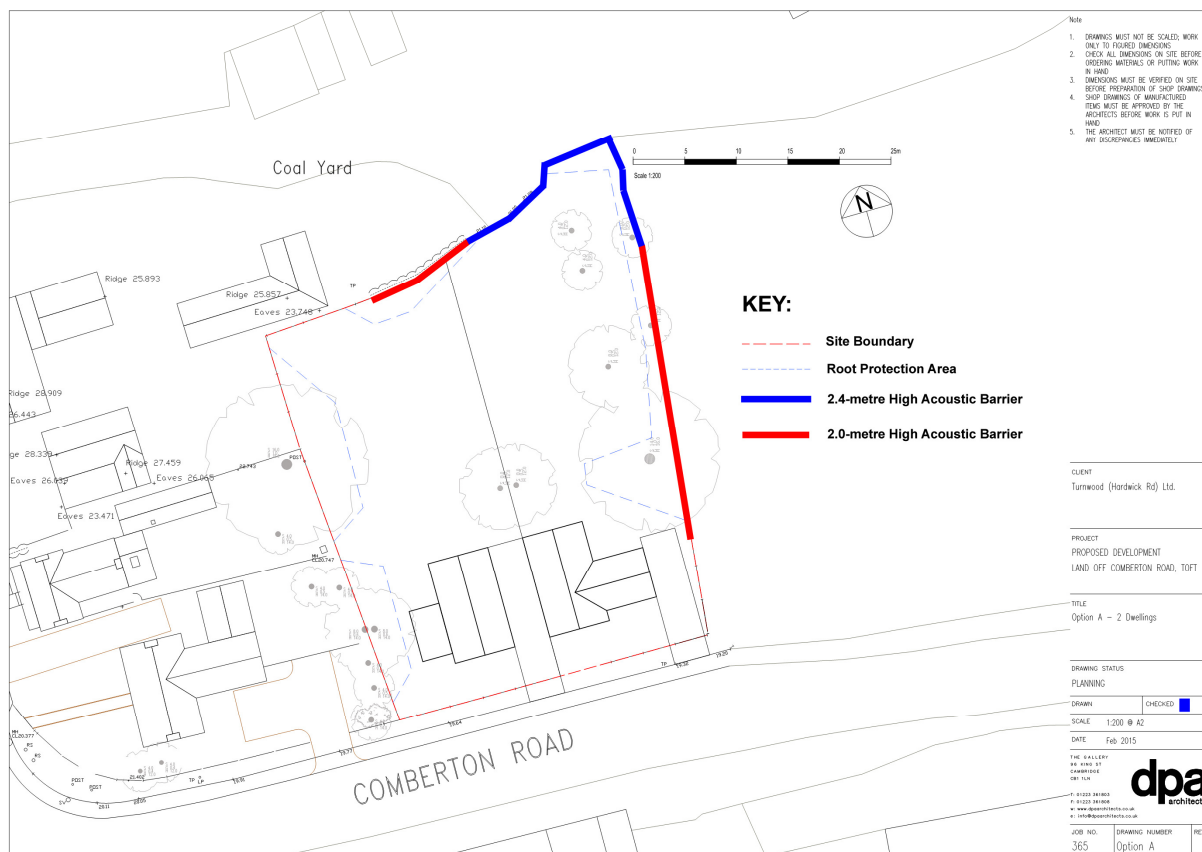


FIGURE 4: ACOUSTIC BOUNDARY TREATMENTS

It is suggested that these barriers are constructed of a close board timber design, with a panel density of $>10\text{kgm}^{-2}$, which is imperforate, continuous and sealed at the base.

Residual Effects

It is considered that the introduction of the barrier system proposed in Figure 4 would reduce the acoustic contribution from the adjacent commercial premises by a magnitude of 5 to 10 dB, depending on receptor location within the garden and height of receptor (seated or standing).

Noise from the commercial activities will still be audible; however, the screening introduced by this mitigation proposal would dramatically reduce its audible impact, while also breaking the line of sight between the source and receiver, which will

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further reduce the subjective impact of the activities (based on the concept of reducing or removing the exposure of one sense, reducing the subsequent sensitivity of another).

The screening effects of the proposed dwellings themselves will also reduce the levels of received noise within the rear gardens, as noise arising from road traffic using Comberton Road will also be mitigated. Consequently, the combined mitigative effects of the proposed screening and built form of the development will ensure that the noise levels within the rear garden spaces of the proposed development will comfortably comply with the 50 dB(A) "desirable" criteria for external living spaces, as set out in BS 8233: 2014 and originally advocated by the World Health Organisation.

It is therefore considered that once mitigated in the manner described within this report, that noise can be adequately controlled at this site, thus ensuring its suitability for residential development.

7 CONCLUSION

MLM Acoustics has been commissioned by Bloomhall to undertake an assessment of noise affecting proposed residential units on land off Comberton Road, Toft.

The suitability of the site for residential development has been assessed based on the current development proposals and the measured noise levels. Where predicted levels indicate that noise may be a determining factor in the granting of planning permission, mitigation measures have been considered to ensure satisfactory conditions are met.

The assessment is based on the findings of an on-site noise survey, tailored to consider all noise sources affecting the site.

The assessment has considered the impacts of both road traffic noise and commercial noise affecting the site, in the context of both BS 8233: 2014 and BS 4142: 2014.

The BS 4142 assessment has identified that in the proposed rear garden areas, that the ambient noise environment is significantly affected by commercial noise, resulting in *prima facie* high levels of commercial noise impact. BS 4142: 2014 does, however, state that such impacts have to be considered in context, which when done so, does reduce the emphasis and subsequent significance of this conclusion.

Mitigation measures have been proposed, both in terms of façade treatment and boundary screening, which when implemented in the manner described will ensure that noise impacts are adequately controlled and appropriate amenity criteria are met, both within and outwith the proposed dwellings.

In the light of the findings of this report, it is considered that noise can be adequately controlled and should not present a constraint to the residential development of this site in its currently proposed form.

Appendices

Appendix A – Glossary of Acoustic Terminology
Appendix B – Noise Measurement Results

Appendix A

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s ₁ and s ₂ is given by 20 log ₁₀ (s ₁ / s ₂). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
L _{eq,T}	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
L _{max,T}	A noise level index defined as the maximum noise level during the period T. L _{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L _{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L _{90,T}	A noise level index. The noise level exceeded for 90% of the time over the period T. L ₉₀ can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L _{10,T}	A noise level index. The noise level exceeded for 10% of the time over the period T. L ₁₀ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE A1: TYPICAL SOUND LEVELS FOUND IN THE ENVIRONMENT	
Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} .

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

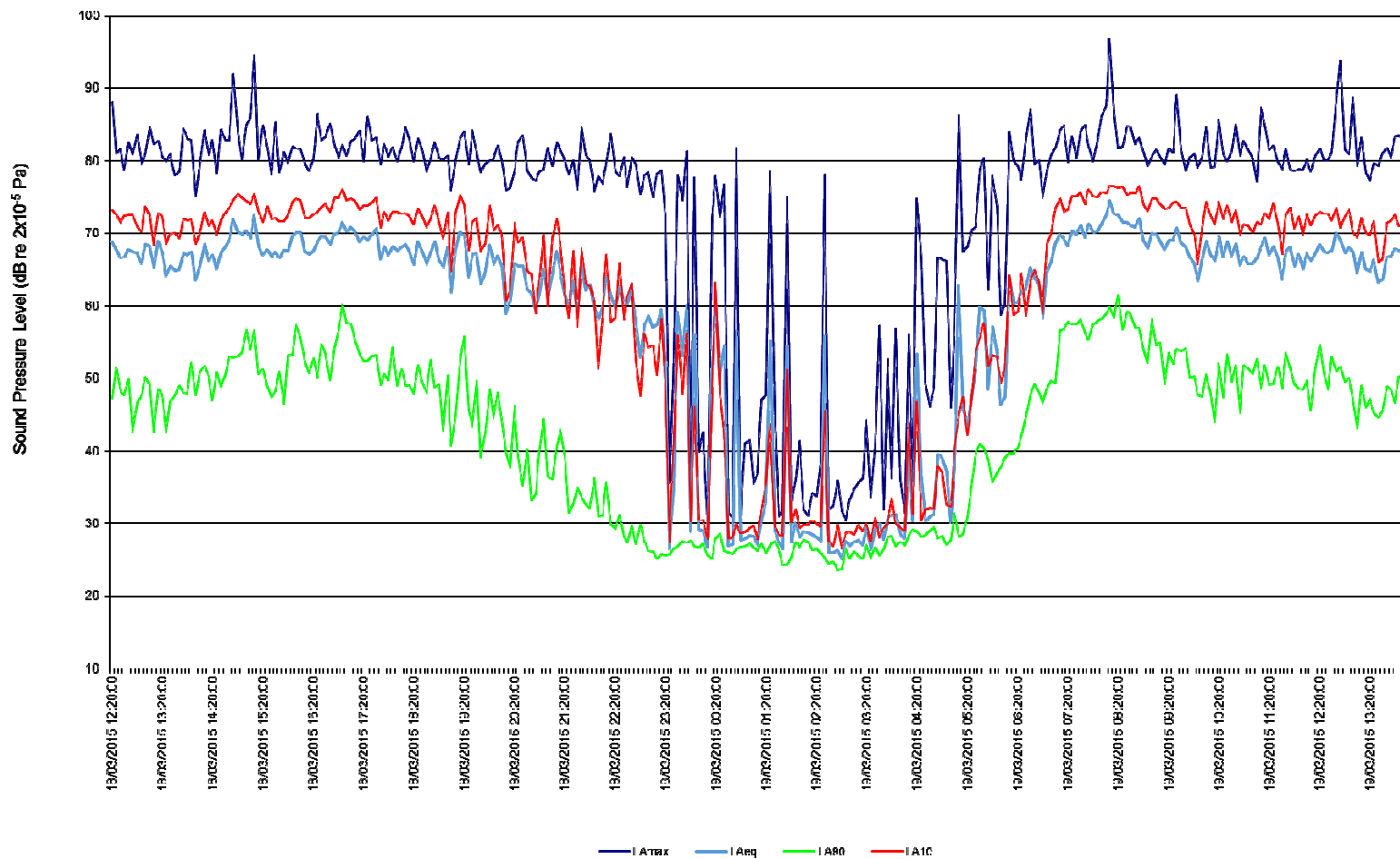
Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 5 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1\text{hour}}$ dB and $L_{A90,5\text{mins}}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

Appendix B

APPENDIX B – NOISE MEASUREMENT RESULTS

Position 1

Comberton Road, Toft-Position 1
Wednesday 18/03/15 and Thursday 19/03/2015
Measured L_{Aeq} , L_{A10} , L_{Amax} and L_{A90} Time Histories



Position 3

Comberton Road, Toft-Position 3
 Wednesday 18/03/15
 Measured L_{A90} , L_{A10} , L_{Amax} and L_{Aeq} Time Histories

