Land at Golden Cross, Chiddingly

Noise Assessment for Planning

14th April 2022

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1. INTRODUCTION

1.1. Overview

inacoustic has been commissioned to assess the impact of noise at a site at Land at Golden Cross, Chiddingly, BN27 4AW in order to discharge a planning condition related to road traffic noise.

The following technical noise assessment has been produced to provide supporting information to discharge a planning condition which has been outlined by Wealden District Council in the decision notice referenced "WD/2020/0249/F" and is based upon environmental noise measurements undertaken at the site and a predictive exercise.

This noise assessment is necessarily technical in nature; therefore a glossary of terms is included in Appendix A to assist the reader.

1.2. Scope and Objectives

The scope of the noise assessment can be summarised as follows:

- A sound monitoring survey was undertaken at discrete locations around the Site;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the existing sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the planning condition and BS8233:2014[1].

[1] British Standard Institution. BS 8233:2014 Guidance on sound insulation and noise reduction for buildings.

2. Legislation and Policy Framework

2.1. Planning Condition

Condition 6 of the decision notice referenced "WD/2020/0249/F" states the following:

"Before any above ground works a noise report to address traffic noise impacts to the dwellings and identify necessary mitigation measures (such as improved double glazing) shall be submitted and approved in writing by the district planning authority. The development shall be carried out in strict accordance with the approved details which shall be fully complete prior to occupation of any dwelling and thereafter retained."

It is therefore anticipated that the internal noise levels shall be determined in accordance with BS8233:2014 guidelines as outlined in the following section.

2.2. British Standards

2.2.1. BS8233:2014

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 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	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.

3. Site Description

3.1. Site and Surrounding Area

The Consented Development is situated at the car park of the Golden Cross Inn. The Consented Development area can be seen in Figure 1, below.

It was noted on site, during the partially attended period, that the ambient sound environment across the site was influenced by road traffic noise arising from vehicles on the A22.

Figure 1: Consented Development Site and Surrounding Area

3.2. Consented Development Overview

The Consented Development comprises of 5 terraced houses, as shown in Figure 2.

It is proposed that the ventilation strategy for the Consented Development will consist of acoustically attenuated trickle vents and standard thermal glazing. Windows will be openable for the purpose of purge ventilation.

FIGURE 2: CONSENTED DEVELOPMENT LAYOUT – BLOCK PLAN, FLOOR PLANS AND ELEVATIONS

4. Measurement Methodology

4.1. General

The prevailing noise conditions in the area have been determined by a largely unattended environmental noise survey conducted during both daytime and night-time periods between Wednesday 6th April to Thursday 7th April 2022.

4.2. Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445[2].

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[3]. A full inventory of this equipment is shown in Table 2 below.

Table 2: Inventory of Sound Measurement Equipment

Measurement Position	Make, Model & Description	Serial Number
MP1	Svan 957 Sound Level Meter	21890
	Svantek SV 12L Preamplifier	24215
	ACO 7052E Microphone	58524
	Cirrus CR:515 Acoustic Calibrator	82501

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.2 dB in the field calibration was found to have occurred on all sound level meters.

The microphone was fitted with protective windshields for the measurements, which are described in Table 3, with an aerial photograph indicating its location shown in Figure 4.

[2] British Standard 7445: 2003: Description and measurement of environmental noise. BSI
[3] British Standard 61672: 2013: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

Table 3: Measurement Position Description

Measurement Position	Description
MP1	A largely unattended measurement of ambient sound at a location representative of the northernmost build line of the Consented development. The measurement was undertaken under free-field conditions, with the microphone located at a height of 1.5 metres above local ground level. The sound environment was dominated by road traffic using the A22.

Figure 3: Measurement Positions

The summarised results of the environmental noise measurements are presented in Table 3.

Table 3: Summary of Noise Measurement Results

Measurement Position	Period	Noise Level, dB			
		$L_{Aeq,T}$	L_{AMax}	L_{A10}	L_{A90}
MP1	Day	66	81	68	56
	Night	62	79	63	49

Table 4: Spectral Measurement Results

Period	dB(A)	Octave Band (Hz) Sound Level (dB)							
		63	125	250	500	1000	2000	4000	8000
MP1									
$L_{eq,T}$									
Day	66	70	66	62	58	62	60	52	48
Night	62	63	60	57	55	58	57	51	48
L_{Amax}									
Night	79	85	73	70	72	75	74	69	67

5. Noise Assessment

5.1. Façade Requirements

In order to achieve appropriate noise levels within internal living spaces, in those areas where such levels will not be achieved with open windows, the dwellings themselves need to be considered with regard to the level of façade mitigation required in order to achieve internal noise levels of $L_{Aeq,16\text{-}hour}$ <35 dB in habitable rooms during the day; $L_{Aeq,8\text{-}hour}$ <30 dB and typical L_{AFMax} levels of <45 dB during the night.

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 Consented 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.

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}, or $R_w + C_{tr}$.

Table 1 in Annex 6 of PPG 24, which is now superseded, but does contain some useful and relevant information, provides examples of typical noise reductions for a dwelling façade with windows set in a brick/block wall. The table shows various levels of noise reduction provided by different glazing configurations and for different noise sources. The values shown are the level difference (in dBA) between the outside and the inside of a typical dwelling and to represent worst case, it is assumed that the outside level is a façade measurement and that the relative contribution though any ventilation elements is negligible.

PPG24 states that standard thermal double glazing will 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 $R_w + C_{tr}$ of 27 dB. This is considered to be a reliable performance expectation in the context of what would be installed on the quietest facades of the development. The 4/12/4 notation refers to a glazing unit comprising a 4 mm pane of glass and a 4 mm pane of glass, separated by a 12 mm air gap.

The Building Regulations recommend on ventilation that habitable rooms in dwellings have whole-dwelling 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 in the majority of rooms 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 each façade component. It is typically assumed that the default choice of glazing for the habitable rooms of the Consented development will be thermal double glazing and the default choice for ventilation will be a hit and miss, window-mounted trickle vent system.

As already stated; in order to provide a robust assessment and a high quality living environment for future residents, providing internal noise levels of <35 dB $L_{Aeq,16\text{-}hour}$ by day and <30 dB $L_{Aeq,8\text{-}hour}$ by night, as well as <45 dB typical L_{AFMax} by night, as defined in BS 8233 has been adopted as the design target for the Consented development.

To determine the glazing and ventilation requirements in order to provide an adequate level of protection against external noise intrusion, $L_{Aeq,16hour}$ daytime, $L_{Aeq,8hour}$ and typical L_{AFMax} night-time noise levels have been determined at the building façade.

Accordingly, the required sound level difference from outside to inside for the building facades of the development, to provide appropriate internal noise levels during both daytime and night-time periods, as described, are identified in Table 5.

TABLE 5: REQUIRED SOUND LEVEL DIFFERENCE OUTSIDE TO INSIDE

Index	Measured Free-field Noise Level, dB		Target Internal Noise Level - dB		Required Sound Level Difference, dB
	Day	Night	Day	Night	
All Facades					
$L_{Aeq,T}$	66	62	35	30	32
L_{AFMax}	-	79	-	45	34

It should be noted that the sound reduction 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, lower performance standards would be permissible.

Based upon the latest layout proposals, calculations have been carried out to determine the likely required acoustic performances for the external façade elements, in order to provide appropriate internal noise levels in rooms during both the daytime and night-time periods.

The outline performance requirements are presented in Table 6.

Table 6: Minimum Acoustic Performances for Glazing and Ventilation

Example Glazing	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	R_w
	Sound Reduction Performance, R dB							
All Facades								
10mm Glazing/12mm Air Gap/6mm Glazing + 4mm Glazing (Bonded) Laminated Double Glazing	23	27	29	36	41	42	52	39
Example Ventilation	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	$D_{n,e,w}$
	Element Normalised Level Difference ($D_{,n,e}$) dB							
All Facades								
Acoustic Trickle Vent	32	40	38	32	47	53	48	42
Example Walls	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	R_w
	Sound Reduction Performance, R dB							
All Facades								
Lightweight Timber Frame Facade	17	22	38	53	58	57	59	46

Other units may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems. The above analysis is provided to demonstrate that a design solution is feasible at the site for the purposes of discharging a Planning Condition and not necessarily for the purposes of detailed design or glazing procurement.

The detailed design of the Consented properties may affect both the required sound reduction performance and the appropriate selection of glazing units. The aspects of the detailed design that are important are the room dimensions, room finishes, window dimensions and the sound reduction performance of non-glazing elements.

6. Conclusion

inacoustic has been commissioned to assess the impact of noise at a site at Land at Golden Cross, Chiddingly, BN27 4AW in respect of the site's suitability for residential development.

This technical noise assessment has been produced to provide supporting information to discharge a planning condition which has been outlined by Wealden District Council in the decision notice referenced "WD/2020/0249/F" and is based upon environmental noise measurements undertaken at the site and a predictive exercise.

The suitability of the site for residential development has been assessed, based on the development proposals and the measured noise levels.

Consideration has been given to the influence of all sources of noise upon the Consented Development, with specific consideration given to the internal noise criteria for the Consented Development, as quoted as within BS8233:2014, with façade mitigation measures proposed to achieve the criteria stipulated therein.

In light of the above, which demonstrates that the site is predicted to meet the requirements of the relevant British Standards, it is suggested that the condition can be discharged.

7. APPENDICES

7.1. Appendix A – Definition of Terms

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 s1 and s2 is given by 20 log10 (s1 / s2). 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 7: 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 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

7.2. Appendix B – Measurement Results

FIGURE 4: MEASURED TIME HISTORY MP1