



Suite 24
Doncaster Business Innovation Centre
Ten Pound Walk
Doncaster
DN4 5HX

Residential New Build Development Land off Main Road, Wigtoft, Lincolnshire Noise Impact Assessment

For:

Broadgrove Planning and Development Limited

13 January 2023

Ref: NIA-10682-22-10874-v1

Issue: Final

Author: R. Habeshaw MSc, MIOA

Contents

1	Introduction	1
2	Site Layout and Development Proposals	2
3	Conditions and Planning Guidance	3
3.1	LPAs Requirements	3
3.2	ProPG Planning and Noise: New Residential Development	3
4	Noise Survey and Results	5
5	Noise Assessment	6
5.1	Façade Design Levels	6
5.2	Internal Noise Predictions	8
5.3	External amenity	9
6	Summary and Conclusions	10
	Appendix A – Abbreviations and Definitions	11
	Appendix B – Noise Measurement Positions	1
	Appendix C – Site Layout	1

1 Introduction

- 1.1.1 Environmental Noise Solutions Ltd (ENS) has been commissioned by Broadgrove Planning and Development Limited to undertake a noise impact assessment for a residential new build development on Land off Main Road, Wigtoft, Lincolnshire (hereafter referred to as ‘the site’).
- 1.1.2 Outline planning permission (ref: B/19/0457) for the residential development of the site was granted by Boston Borough Council (BBC) in February 2020, subject to conditions. Condition 11 relates to the control of noise as follows:
- ‘11. When the application is submitted for the reserved matters it shall be accompanied by a noise assessment that considers the existing noise climate from the adjacent employment site located to the east of the application site.’
- 1.1.3 The objectives of this noise impact assessment are to:
- Assess external ambient and background noise levels in the vicinity of the site during relevant time periods.
 - Assess the potential impact of the existing ambient noise climate on the proposed residential development with reference to relevant guidelines
 - Provide recommendations for a scheme of sound attenuation works, as necessary
- 1.1.4 This report details the methodology and results of the assessment and provides recommendations for the building envelope (fenestration and ventilation) and barrier shielding where appropriate. It has been prepared to accompany a reserved matters planning application to be submitted to BBC for the proposed residential development.
- 1.1.5 This report details the methodology and results of the assessment. It has been prepared for Broadgrove Planning and Development Limited for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult the aforementioned and ENS as to the extent to which the findings may be appropriate for their use.
- 1.1.6 A glossary of acoustic terms used in the main body of the text is contained in Appendix A.

2 Site Layout and Development Proposals

- 2.1.1 The proposals are for approximately 9 dwellings across the site with associated parking and landscaping.
- 2.1.2 The noise environment at the site is controlled by traffic noise on the A17 and Main Road to the south with a commercial vehicle repair garage (Autotruck Limited) immediately to the east of the site. Opening hours at the garage are 0600–2200 hours Monday to Friday, and 0600–1200 hours on weekends.
- 2.1.3 An indication of the extent of the development site is given in Figure 2-1 below with the measurement positions shown in Appendix B and the site layout shown in Appendix C.

Figure 2-1: Location Plan



3 Conditions and Planning Guidance

3.1 LPAs Requirements

3.1.1 Outline Planning Permission for the development (B/19/0457) states in Condition 11:

“When the application is submitted for the reserved matters it shall be accompanied by a noise assessment that considers the existing noise climate from the adjacent employment site located to the east of the application site.”

3.1.2 For the purposes of this noise assessment the following guidance is considered relevant:

3.2 ProPG Planning and Noise: New Residential Development

3.2.1 ProPG Planning and Noise: New Residential Development (ProPG) was published in May 2017 by the Association of Noise Consultants, Institute of Acoustics and the Chartered Institute of Environmental Health.

3.2.2 Stage 1 of ProPG comprises an initial site noise risk assessment which correlates external noise levels at the site with the risk of an adverse impact. For reference, Figure 1 of ProPG indicates that daytime noise levels of < 60 dB L_{Aeq} (0700-2300) are assessed as **low risk** in terms of adverse impacts.

3.2.3 Stage 2: Element 2 of ProPG sets indoor ambient noise levels for residential dwellings based on the guidance contained in British Standard 8233:2014 ‘Guidance on Sound Insulation and Noise Reduction for Buildings’ (BS 8233) (see table below).

Table 3.1 – Indoor Ambient Noise Levels in Dwellings

Activity	Location	Good Indoor Ambient Noise Levels	
Resting	Living Room	35 dB L_{Aeq} (0700–2300)	-
Dining	Dining Room/Area	40 dB L_{Aeq} (0700–2300)	-
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} (0700–2300)	30 dB L_{Aeq} (2300–0700) 45 dB L_{AFMax} (2300–0700)

3.2.4 Note 5 to the above table states: ‘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.’

3.2.5 This is consistent with Planning Practice Guidance (PPG) specifically dealing with noise, which was uploaded to the Government’s Planning Portal in March 2014 as an accompaniment to the NPPF. This guidance was further updated in December 2014.

3.2.6 The guidance states ‘... consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations’.

3.2.7 On the basis of the above, the following criteria (with windows closed and trickle vents open) are considered appropriate for the proposed residential development:

- ≤ 35 dB L_{Aeq} (0700-2300) in living rooms and bedrooms during the day
- ≤ 30 dB L_{Aeq} (2300-0700) and 45 dB L_{AFMax} not normally exceeded in bedrooms during the night

3.2.8 These internal ambient noise levels represent good resting and sleeping conditions.

3.2.9 With respect to external amenity, ProPG reflects the advice in BS 8233, as follows:

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 $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ 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. 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.'

4 Noise Survey and Results

4.1.1 In order to assess the current noise levels at the subject site, a noise survey was undertaken on Wednesday 7th and Thursday 8th of December 2022.

4.1.2 For the purposes of the background noise assessment, three measurement locations were taken in the following positions:

- MP1 located 30 metres from Main Road and 2 metres from the eastern boundary
- MP2 located at a distance of 8 metres from Main Road and 2 metres from the eastern boundary
- MP3 located at the mid-western boundary at a distance of 10 metres from Asperton Road

4.1.3 Noise measurements were made in free field conditions using a Bruel & Kjaer 2250 Type 1 integrating sound level meter. A windshield was fitted for all measurements. The calibration of the measurement system was verified immediately before and after the survey using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions throughout the survey were appropriate for monitoring with dry weather and windspeed below 5 ms⁻¹.

4.1.4 Measurements consisted of A-weighted broadband parameters, together with linear octave band L_{eq} levels. Table 4-1 presents a summary of the measurement data for each measurement session, rounded to the nearest decibel.

Table 4-1 – Summary of Noise Measurement Data

Location	Date	Time (hh:mm)	Length (hh:mm)	L_{Aeq} (dB)	$L_{Amax,F}$ (dB)	L_{A90} (dB)	L_{A10} (dB)	Comment
MP1	07/12/2022	10:30	01:00	56	72	49	59	Traffic on Main Road and A17 carriageway, vehicle movements/revs, occasional pressure washer and workshop impacts (e.g. hammers, drills) from adjacent garage
		11:30	01:00	57	74	50	60	
		12:30	01:00	56	75	49	59	
		13:30	01:00	56	74	49	60	
		19:03	01:00	55	78	46	57	
		20:03	01:00	57	76	47	59	
	08/12/2022	05:34	00:11	53	65	44	56	Traffic on Main Road and A17 carriageway, occasional vehicle movements/revs and workshop impacts from 0615 hours
		05:45	00:15	51	64	46	54	
		06:00	00:15	51	61	47	53	
		06:15	00:15	57	73	49	62	
		06:30	00:15	56	67	51	60	
		06:45	00:15	57	68	50	60	
MP2	07/12/2022	14:35	00:30	63	80	51	66	Traffic on Main Road dominant, distant A17, noise from garage yard
	08/12/2022	10:35	03:00	63	81	50	66	
MP3	07/12/2022	13:40	00:30	58	77	50	61	Local and distant road traffic, distant noise from garage

4.1.5 Daytime noise levels at the eastern boundary of the site (MP1) were measured up to 57 dB L_{Aeq} (1 hour) with levels of up to 57 dB L_{Aeq} (15 min) during the night-time (early morning) period. Maximum noise levels associated with the adjacent garage were measured at up to 78 dB L_{AFmax} during the daytime and up to 73 dB L_{AFmax} during the night-time. For a robust scenario, the higher (daytime) level is used for assessment purposes.

4.1.6 Levels at MP2 and MP3 are driven by road traffic noise generally with additional contribution from the garage workshop. MP2, closer to Main Road, showed levels up to 63 dB L_{Aeq} , and $L_{Amax,F}$ of ≥ 80 dBA. With correction for distance to the position of the front façade of the dwellings these levels would reduce by approximately - 1.5 and - 3 dBA to 61 dB $L_{Aeq,T}$ and 78 dB L_{AFmax} . MP3 had a lower $L_{Aeq,T}$ of 58 dBA during the daytime monitoring period.

5 Noise Assessment

5.1 Façade Design Levels

5.1.1 Daytime and night-time (early morning) ambient noise levels at MP1 were measured at:

- ≤ 57 dB L_{Aeq} (1 hour) during the daytime
- ≤ 57 dB L_{Aeq} (15 min) during the night-time

5.1.2 The NPPF PPG requires that the *character* of the noise is taken into account. In relation to the guide levels contained in Table 3.1, with cognisance to the adjacent HGV Workshop, Paragraphs 2.42 and 2.43 of ProPG clarify:

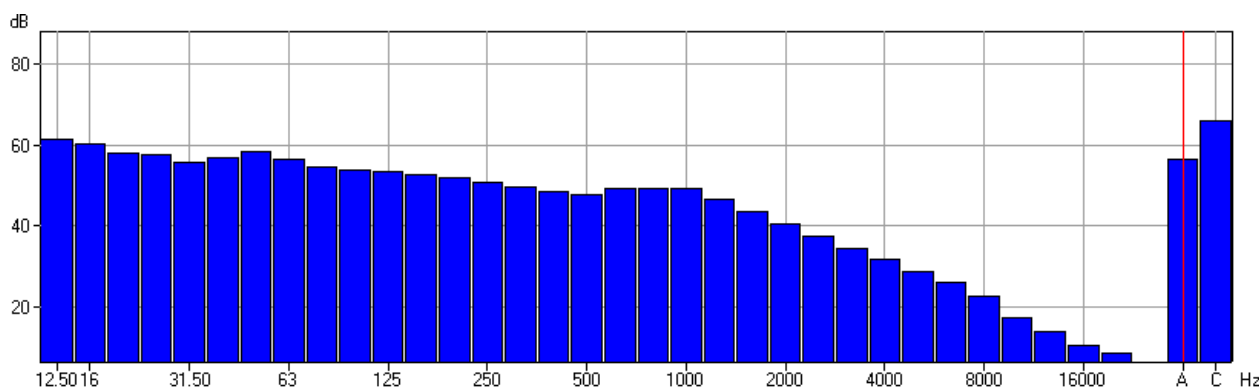
However, great care should be taken when considering using the noise level guidelines in Figure 2 in circumstances where industrial and/or commercial noise is present but “not dominant”. Issues that may arise include:

- *Are there particular acoustic features (tones, impulses etc.) in the industrial and/or commercial noise that may increase its effect compared to sounds without such features? Are there any non-acoustic features that may also have an effect?*
- *Will the time averaging over the 16 hour day or 8 hour night intervals used in Figure 2 lead to underestimation of the impacts of industrial and/or commercial noise that may occur for shorter but still substantial periods at a higher level?*

*Professional judgement will have to be exercised in addressing these sorts of issues. **One possible approach may be to apply BS 4142:2014 character corrections to the noise level guideline values in order to derive suitable effect thresholds and/ or mitigation design targets** and to use the same reference time periods recommended in the standard.*

5.1.3 British Standard BS 4142:2014 ‘Methods for Rating and Assessing Industrial and Commercial Sound’ (BS 4142) provides guidance on adjustments for the characteristic features of the sound. The character correction relates to whether and to what degree the specific sound is assessed to have an element of tonality, impulsivity and/or characteristics that are readily distinctive against the residual acoustic environment.

5.1.4 In terms of particular acoustic features, noise from the workshop adjacent to the subject site was noted to be broadband (i.e. not tonal). This observation is corroborated by noise measurement data which illustrates the spectrum is not objectively tonal (in accordance with Annex C of BS 4142). See below for the one-third octave frequency spectrum of noise measurement data as measured at MP1 (between 1030–1430 hours).



5.1.5 Noise associated with the workshop did however contain infrequent impulses. On this basis, a **+6 dB impulsivity penalty** is considered robust.

5.1.6 It is considered that applying this correction to worst case noise levels measured at MP1 (note: these measurements include road noise contribution as well as plant noise), whilst assessing the development to ProPG/BS 8233 criteria, represents a robust assessment methodology.

5.1.7 Including a +6 dB character correction, design noise levels for dwellings fronting towards the vehicle workshop are therefore:

- $\leq 63 \text{ dB } L_{Aeq} (1 \text{ hour})$ during the daytime
- $\leq 63 \text{ dB } L_{Aeq} (15 \text{ min})$ during the night-time
- $\leq 78 \text{ dB } L_{A_{Max,F}}$ during the night-time (based on (higher) measured daytime level)

5.1.1 Daytime noise levels at MP2 were measured at 63 dB $L_{Aeq,T}$ with an average $L_{A10,3hr}$ of 69 dBA.

5.1.2 The Department of Transport's Memorandum on the Calculation of Road Traffic Noise (CRTN) explains that the following shortened measurement procedure may be used to predict daytime road traffic noise: Measurements of L_{A10} are made over any three consecutive hours between 10:00 and 17:00 hours.

5.1.3 Using $L_{A10} (3 \text{ hour})$ as the arithmetic mean of the three consecutive values of hourly L_{A10} , the $L_{A10(0700-2300)}$ can be calculated from the equation:

Equation 5-1

$$L_{A10,(0700-2300)} = L_{A10,3hr} - 1 \text{ dB}$$

5.1.4 A study prepared by TRL Limited on behalf of the Department for Environment, Food and Rural Affairs (DEFRA) entitled 'Converting the UK Traffic Noise Index $L_{A10(0700-2300)}$ to EU Noise Indices for Noise Mapping' presents a methodology for calculating daytime $L_{Aeq(0700-2300)}$ and night-time $L_{Aeq(2300-0700)}$ ambient noise levels based on the $L_{A10} (18 \text{ hour})$ noise levels, as follows:

Equation 5-2

$$L_{Aeq,(0700-2300)} = 10 \log \left(\frac{12 \times 10^{\left(\frac{0.95L_{A10,(0700-2300)} + 1.44}{10}\right)} + 4 \times 10^{\left(\frac{0.97L_{A10,(0700-2300)} - 2.87}{10}\right)}}{16} \right) \text{ dB}$$

Equation 5-3

$$L_{Aeq,(2300-0700)} = 0.9 \times L_{A10,(0700-2300)} - 3.77 \text{ dB}$$

5.1.5 Based on the above formulae, habitable rooms facing onto Main Road are expected to be exposed to road traffic noise of up to:

- $\leq 61 \text{ dB } L_{Aeq} (0700-2300)$ during the daytime
- $\leq 53 \text{ dB } L_{Aeq} (2300-0700)$ during the night-time
- $\leq 78 \text{ dB } L_{A_{Max,F}}$ during the night-time (based on maximum daytime traffic noise events)

5.2 Internal Noise Predictions

- 5.2.1 Based on the noise levels summarised above, noise levels for the development are above the level at which ventilation via partially open windows would be adequate over the day and night-time periods.
- 5.2.2 Therefore, the assessment assumes that windows will be closed (for the worst affected dwellings) as part of the noise mitigation strategy for the site. Windows can be opened for temporary purge ventilation (to enable discretionary rapid air changing) with resultant internal levels slightly exceeding the noise criteria; however, this would be on a temporary basis.
- 5.2.3 In conjunction with the noise barrier detailed in Section 5.3, it is recommended enhanced double glazing and trickle vents are required to achieve satisfactory internal noise levels for the bedrooms facing onto Main Road and for the rear 1st floor bedrooms of plots 1 & 9.
- 5.2.4 Standard double glazing and tricklevents would be expected to achieve satisfactory internal noise for all livingrooms and remaining bedrooms on site.
- 5.2.5 Calculations have been performed to determine the configuration of glazing and ventilation, required for the most exposed dwellings, to satisfy the internal noise criteria.
- 5.2.6 Calculations incorporate the measured external noise level data and the noise ingress calculation methodology outlined in Annex G.2 of BS8233:2014. Room and façade dimensions are speculative, assuming a façade area of 7m² with 2m² of glazing and a total volume of 27 m³.
- 5.2.7 All plots are assumed to have passive ventilation with a minimum EA of 8000mm², as per guidance in ADF.
- 5.2.8 It was determined that the day and night-time internal noise requirements can met in the worst case, for all bedroom windows facing Main Road (and the rear 1st floor of Plots 1 & 9), with a minimum performance for façade attenuation of **33 R_w+C_{tr}** for glazing and **40 $D_{n,e,w}+C_{tr}$** for trickle ventilation (assuming 8000mm² equivalent for ADF requirements).
- 5.2.9 For the all remaining windows on the properties (Rear ground floor façades, rear 1st floor bedrooms of plots 2 to 6 and all windows of Plots 7 & 8) double glazing with a performance of **28 R_w+C_{tr}** in conjunction with acoustic trickle vents providing a minimum **34 dB $D_{n,e,w}+C_{tr}$** should be provided.
- 5.2.10 Table 5-2 details the minimum required performance levels for the indicated dwellings.

Table 5-2: Required Sound Reduction of Façade Elements

Element	Required Sound Reduction (dB)						Indicative Specification
	125 Hz	250 Hz	500 Hz	1kHz	2kHz	Weighted R _w (R _w +C _{tr}) / D _{n,e,w} (D _{n,e,w} +C _{tr})	
All bedrooms facing onto Main Road and Garage workshop facing 1 st floor bedrooms of Plots 1 & 9							
Glazing	23	24	34	42	43	38(33)	Pilkington Enhanced - 6 / 6-20 / 8.8 Optiphon
Ventilation	47	38	36	41	55	42(40)	Invisivent®EVO AK Ultra (EA: 7016mm²/1m)
All remaining windows							
Glazing	21	20	26	38	37	32(28)	6 mm glass / 16 mm cavity / 4 mm glass double glazing
Ventilation	36	38	36	32	43	35(34)	Titon SFX 4000 EA 434mm / SFSA C25

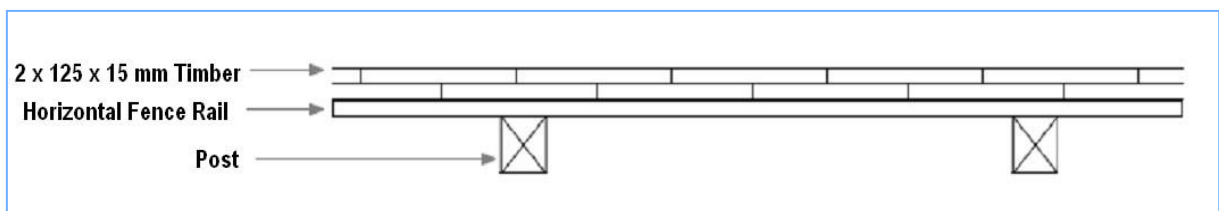
- 5.2.11 The glazing recommendations apply to the window within a sealed unit. It is the responsibility of the window supplier to ensure that the window frame does not compromise the performance of the glazing.

- 5.2.12 When selecting a glazing system to satisfy the requirements outlined above, it is important to ensure that the $R_w + C_{tr}$ value is achieved (rather than simply the R_w value). Published R_w values tend to be higher than corresponding $R_w + C_{tr}$ values; therefore, incorrect selection could result in an overestimation of sound reduction performance which in turn could result in higher internal noise levels.
- 5.2.13 The Invisivent®EVO AK Ultra can achieve an EA of 7016mm² per 1 metre length, if this is not suitable for the window size, alternative ventilation can be provided such as through-wall vents with an equivalent $D_{new} + C_{tr}$ value such as the Ryton AAC125HP.
- 5.2.14 Alternatively, a positive input ventilation (PIV) system may allow for adequate ventilation without the requirement for trickle or through-wall vents. It is understood that background ventilators may not be required for 2 storey dwellings if the designed air permeability of the dwellings is between 3 to 5 m³/(h.m²). The suitability of such a system would require confirmation by the developer.

5.3 External amenity

- 5.3.1 The rear gardens will be partially shielded from road noise, with an average level expected to be equivalent to approximately 53 dB $L_{Aeq,T}$ (given distance attenuation and - 3 dB for partial shielding), bringing the level within the upper limit of the BS8233 external amenity area criteria of 50 – 55 dBA, however the contribution from noise within the adjacent yard of ≤ 57 dBA lies above this criteria.
- 5.3.2 We therefore recommend a noise barrier with a height of 3 metres is erected along the eastern boundary to cover all ground floor amenity areas (see Appendix C for location of barrier). A prediction based on barrier attenuation and distance, using the measured octave levels of the workshop noise, gives average levels of 43 to 47 dB $L_{Aeq,T}$ for garden areas in response to the expected noise from the workshop, safely below the requirement.
- 5.3.3 In order to act as a barrier, any boundary screening should be imperforate and have a mass per unit area of 10 kg/m². An effective barrier is required to be unbroken along its length and should be composed of solid wall, closed boarded fencing, or a combination of types. Where timber fencing is used, a concrete gravel board is recommended to ensure that there are no gaps underneath the barrier. Figure 5-1 shows an example construction of an overlapping timber fence noise barrier.

Figure 5-1: Example Timber Noise Barrier Construction



6 Summary and Conclusions

- 6.1.1 A noise impact assessment has been undertaken for a proposed residential development on Land off Main Road, Wigtoft, Lincolnshire.
- 6.1.2 The noise environment at the subject site is controlled by local road traffic on Main Road, distant road traffic on the A17, and noise from the adjacent HGV workshop.
- 6.1.3 A scheme of façade sound insulation works has been recommended in Section 4 in order to achieve the recommended internal noise criteria set out in Section 2 of this report.
- 6.1.4 Mitigation of external noise levels in the form of acoustic fencing is recommended in order to shield the ground floor and private gardens from noise from the workshop. Mitigated noise levels in all external areas are predicted to be within recommended guideline noise levels with the barrier in place.

Appendix A – Abbreviations and Definitions

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 μ Pa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 μ Pa).

A-weighting

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T , has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T . $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T . L_{A90} is typically taken as representative of background noise.

$L_{AF \max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Single Event Level / Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, regardless of the event duration. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_w)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_w is used to characterise the insulation of a material or product that has been measured in a laboratory).

Appendix B – Noise Measurement Positions



Appendix C – Site Layout

