



Custom House

Residential Noise Assessment





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CONTENTS	PAGE
1 Introduction	1
2 Site Description	2
3 Assessment Methodology	3
4 Environmental Noise Measurements	6
5 Noise Assessment	8
6 Mitigation	11
7 Conclusions	12
APPENDIX A – Introduction to noise	13
APPENDIX B – Figures	15



1 INTRODUCTION

- 1.1 Entran Ltd has been commissioned to undertake a noise assessment for a proposed residential development at the Custom House in Gravesend.
- 1.2 The assessment has been prepared to support a planning application for the Proposed Development to be submitted to Gravesham Borough Council. The assessment considers the existing ambient noise and the suitability of the site for residential use.
- 1.3 This assessment has been prepared in response to an objection from the neighbouring Port of London Authority (PLA). The PLA building is situated approximately 50 m from the Proposed Development site at the closest point. The PLA car park is immediately adjacent to the Proposed Development.
- 1.4 The potential noise impacts are assessed in accordance with the most relevant national and local standards and guidelines.
- 1.5 This report is necessarily technical in nature and contains terminology relating to acoustics and noise. Therefore, a glossary together with a brief introduction to the subject of noise has been provided in Appendix A.

3 ASSESSMENT METHODOLOGY

National Policy

National Planning Policy Framework (NPPF) (July 2021)

- 3.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England. It attempts to summarise 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.
- 3.2 Under Section 15; Conserving and enhancing the natural environment, the following is stated in paragraph 174:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

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

- 3.3 The NPPF goes on to state in paragraph 185 that:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*



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

- 3.4 The scope of BS 8233 is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate.
- 3.5 This Standard suggests suitable internal noise levels within different types of buildings, including residential dwellings. It suggests that an internal noise level of 30 dB $L_{Aeq, T}$ within bedrooms is a 'desirable' standard. For living areas during the daytime, the standard recommends 35 dB $L_{Aeq, T}$ as a desirable standard for resting.
- 3.6 Whilst BS 8233 recognises that a guideline value may be set in terms of SEL or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated. Accordingly, reference has been made in this assessment to the World Health Organisation (WHO) 1999: *Guidelines for Community Noise*.
- 3.7 The Standard also states that “*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.*”

The Institute of Environmental Management & Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (2014)

- 3.8 The Institute of Environmental Management and Assessment (IEMA) have recently published the ‘*Guidelines for Environmental Noise Impact Assessment*’. The guidelines are applicable to noise impact assessment for any scale of development proposal, including core principles to achieve effectively integration with the EIA, and provide advice on the issues that need to be considered in a noise impact assessment and whether the appropriate conclusions are being reached. The factors include:
- The appropriateness of the noise parameters used for the situation;
 - The reference time period used in making the assessment;
 - The level, character and frequency content of the noise sources under investigation; and,



- How the predicted noise levels relate to relevant Standards and guidelines.

3.9 The guidelines also recommend that the assessor should determine the degree of impact based on evidence derived from the assessment.

The Professional Practice Guidance on Planning and Noise (2017)

3.10 The 'Professional Practice Guidance on Planning and Noise' (ProPG) has been produced by a Working Group consisting of representatives of the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH) to provide acoustical practitioners with guidance on the management of noise within the planning system in England.

3.11 The reparation of the ProPG acknowledges and reflects the Government's overarching NPSE, the NPPF and Planning Practice Guidance (including PPG-Noise), as well as other authoritative sources of guidance. It provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, aims to:

- advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- encourage the process of good acoustic design in and around new residential developments;
- outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- promote appropriate noise exposure standards; and,
- assist the delivery of sustainable development.

4 ENVIRONMENTAL NOISE MEASUREMENTS

- 4.1 Noise conditions in the vicinity of the Proposed Development have been determined by an environmental noise survey conducted between 22nd and 26th April 2022.
- 4.2 The monitoring equipment was situated at a likely worse-case position at the balcony area of the existing building. This position immediately overlooks the PLA car park and is the closest façade position to the PLA building. It is also the closest proposed residential façade to the River Thames.
- 4.3 This worse-case location is considered to be directly representative of the north and west facades as well as the balcony area. In order to maintain a cautious assessment and suitably address the PLA concerns, this location has also been adopted as representative of all proposed residential facades. The monitoring position is indicated in Figure 2.

Figure 2 – Unattended Monitoring Position



4.4 A summary of the unattended survey is provided in Table 1 and graphical representation of the unattended results is presented in Figure B1 and Figure B2 of Appendix B.

Table 1: Summary of Existing Noise Data

Date	Measured Free-Field Sound Pressure Level, dB re. 2×10^{-5} Pa.					
	Day Time (07:00 - 23:00)			Night-time (23:00 - 07:00)		
	$L_{Amax,F}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Amax,F}$	$L_{Aeq,T}$	$L_{A90,T}$
22/04/2022	75.2	51.0	46.9	73.4	46.7	41.1
23/04/2022	73.3	51.4	47.7	65.3	43.6	38.9
24/04/2022	79.3	48.7	42.9	75.5	44.0	37.4
25/04/2022	81.2	48.0	42.1	70.3	44.9	40.4
26/04/2022	67.5	48.1	43.1	-	-	-

Maximum levels represent the highest $L_{Amax,F}$ sound level during the given period.

The period $L_{Aeq,T}$ is obtained from the logarithmic average of measured sound levels.

The period $L_{A90,T}$ is obtained from the average of the measured sound levels.

4.5 The unattended noise monitoring was undertaken to inform assessment in accordance with BS 8233 and to determine the likelihood of adverse effects relating to the Proposed Development.

4.6 All noise measurements were undertaken by competent individuals with experience in environmental noise monitoring. Measurements were obtained in accordance with the principles of BS 7445: 2003: 'Description and measurement of environmental noise'. All acoustic measurement equipment used during the noise surveys conformed to Type 1 specification of British Standard 61672: 2003: *Electroacoustics. Sound level meters. Part 1 Specifications*.

4.7 The monitoring equipment was calibrated before and after the unattended survey. There was no significant drift in calibration measurements observed during the survey period.

4.8 The microphone was positioned at first floor level approximately 1m from the corner of the existing facade. Measurements were undertaken at a position that may be subject to reflections from the existing building façade and therefore cannot be considered as free-field. No correction has been applied to account for this, in order to maintain a cautious consideration of noise levels at the Proposed Development.



5 NOISE ASSESSMENT

Existing Ambient Noise Levels

- 5.1 The existing noise levels at the application site have been assessed by comparing the results of the environmental noise survey with the guidance provided in BS 8233 and the WHO Guidelines.
- 5.2 The measured ambient noise levels have been averaged to obtain representative day and night time noise levels. Internal ambient noise levels have been calculated using the typical façade reductions detailed in BS 8233. The reduction from a façade is taken to be 15 dB and 33 dB for partially open windows and for windows closed, respectively.
- 5.3 Calculated daytime and night-time noise levels at the Proposed Development are presented in Table 2.

Table 2 – External and Internal Ambient Noise Levels

Period	Maximum Noise Level, $L_{Amax,F}$	Sound Pressure Level, $L_{Aeq,T}$ dB re. 2×10^{-5} Pa.		
		External	Internal (Windows Partially Open)	Internal (Windows Closed)
Day	81	50	35	17
Night	76	45	30	12

- 5.4 The ambient noise levels indicate that during the day and night-time the highest average ambient noise levels are 50 dB $L_{Aeq,16\text{ hr}}$ and 45 dB $L_{Aeq,8\text{hr}}$ respectively. The highest measured night-time maximum noise level was 76 dB $L_{Amax,F}$.
- 5.5 BS 8233:2014 provides guideline values for external amenity areas and internal rooms during the day and night. Assessment of the external and internal noise levels is presented in Table 3.

Table 3: Assessment of Ambient Noise Levels

BS 8233 Assessment	Outdoor Amenity (daytime)*	Internal (Windows Partially Open/Windows Closed)		
		Living Rooms & Bedrooms (daytime)	Dining Areas	Bedrooms (night time)
<i>Excess of BS 8233 Criteria</i>	0/-5	0 / -18	-5 / -23	0 / -18
BS 8233 Criteria Achieved	Y	Y/Y	Y/Y	Y/Y

* values provided for upper and lower guideline noise levels (50 and 55 dB, respectively)

- 5.6 The assessment indicates that the existing ambient noise levels achieve the BS 8233 threshold criteria for internal ambient noise levels with both windows closed and windows partially open. Therefore, no specific mitigation is considered to be required in order to achieve the BS 8233 criteria.
- 5.7 External ambient noise levels meet both the upper guideline and desirable noise levels as provided within BS 8233. External amenity noise levels are therefore considered to be suitable.
- 5.8 The WHO Guidelines states that indoor noise levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times a night to ensure there are no negative health effects related to sleep disturbance.
- 5.9 Considering the façade sound reduction from typical design, as used in the BS 8233 assessment, maximum night time noise levels with windows closed and assessed over 1-minute periods, do not exceed 45 dB during any night time period and therefore achieve the WHO criteria of 45 dB.
- 5.10 With consideration to the guidance provided within BS 8233, the assessment indicates that typical insulated double glazing and attenuated trickle ventilation would be sufficient to mitigate noise levels within residential dwellings at the Proposed Development.
- 5.11 A reduction of 17 dB is required to achieve the WHO criteria for internal maximum noise levels. This is 2 dB above the typical value adopted for partially open windows as provided within BS 8233. The typical reduction, with closed windows, due to insulated double glazing and attenuated trickle ventilation is given as 33 dB. Maximum noise levels are therefore likely to be adequately controlled with typical glazing and trickle ventilation.

Noise Rating Curve NR 30

- 5.12 Ambient noise levels are likely to be adequately controlled with typical insulated double glazing and trickle ventilation and no specific requirement for mitigation has been identified.
- 5.13 Notwithstanding this, octave band noise levels have been considered in order to account for the possibility of low frequency noise due to the proximity to marine vessels. This is not considered as a requirement due to the low ambient noise levels. However, consideration has been made to ensure any concerns regarding this are suitably addressed.
- 5.14 An indicative requirement for the minimal reduction that should be afforded by installed glazing and ventilation has been calculated by considering the excess of the highest measured octave band noise levels over the NR 30 curve. The NR 30 curve is typically adopted as the maximum noise rating curve that should be achieved within private dwellings at night-time to minimise impacts relating to the indoor environment.
- 5.15 A 5 dB correction has been applied to the calculated requirement to provide a cautious consideration of requirements and allow for any margin of error due to variation in levels at the site.
- 5.16 This correction, in addition to consideration of the maximum measured octave band noise levels during any period, is taken to constitute a highly cautious approach to the consideration of noise levels against the typical night-time noise rating curve.
- 5.17 Consideration of external 15-minute L_{Aeq} noise levels against the NR 30 curve is presented in Table 4.

Table 4: Assessment of Ambient Noise Levels

Consideration of Night-time NR 30	Octave Band Sound Level, Hz, dB re. 2×10^{-5} Pa.								
	31.5	63	125	250	500	1k	2k	4k	8k
NR 30	76	59	48	40	34	30	27	25	23
External Level	82.0	73.8	59.5	54.3	53.4	51.6	47.9	47.1	47.2
Indicative Requirement ¹	-11.0	-19.8	-16.5	-19.3	-24.4	-26.6	-25.9	-27.1	-29.2
Sample Glazing ²	-21.0	-23	-25	-27	-38	-48	-47	-55	-55

¹ 5 dB correction applied for margin of error

² data obtained from Pilkington Optiphon 6-16-8.8 insulating glass units

- 5.18 The data presented in Table 4 indicates that the required reduction is suitably attainable with standard double-glazed units, with the required reduction calculated to be substantially lower than the reduction achieved by a glass panel with a thickness of 6-16-8.8.



6 MITIGATION

- 6.1 Measured ambient noise levels at the Proposed Development are sufficiently low that no specific mitigation options are identified as required.
- 6.2 Notwithstanding this, it may be prudent to ensure that any glazing and ventilation is specified to achieve the octave band reductions as identified in Table 4 as a minimum.



7 CONCLUSIONS

- 7.1 An assessment of the potential noise impacts attributable to the existing ambient environment has been undertaken for the Proposed Development at Custom House in Gravesend.
- 7.2 Unattended noise measurements were undertaken to obtain sound levels representative of the existing environment for assessment in accordance with BS 8233:2014 and the WHO Guidelines for Community Noise.
- 7.3 Measured ambient $L_{Aeq,T}$ noise levels achieve the BS 8233 and WHO criteria for residential rooms both with windows partially open and with windows closed, assuming the typical façade reduction provided in BS 8233.
- 7.4 Internal ambient and maximum noise levels are calculated to be attainable with typical insulated double glazing and attenuated trickle ventilation. The assessment indicates that the BS 8233 criteria for internal ambient noise levels will be met with typical building design. Accordingly, the Proposed Development is considered suitable for residential use without specific consideration of mitigation.
- 7.5 External noise levels meet the BS 8233 criteria and are considered to be suitable for external amenity.
- 7.6 Whilst the BS 8233 assessment indicates that internal ambient noise levels would be suitable at the proposed residential dwellings, the NR 30 noise rating curve has also been considered to allow indicative consideration of octave band noise levels. This consideration was undertaken to ensure that any potential concerns pertaining to low frequency noise are adequately satisfied.
- 7.7 The indicative consideration of the NR 30 curve has been used to identify the minimum glazing and ventilation specification that should be installed at the Proposed Development to ensure octave band noise levels are suitably controlled.
- 7.8 It should be noted that consideration of octave band noise has been undertaken to ensure that impacts are unlikely. Whilst an indicative octave band spectrum has been identified, specific consideration of mitigation has been not been identified as required.



APPENDIX A – INTRODUCTION TO NOISE

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.

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).

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 3dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1dB 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 $L_{A90(1\text{hour})}$ and $L_{A90(5\text{mins})}$. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.



Table A1: Glossary of Terms

Term	Definition
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 $20\mu\text{Pa}$.
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.
$L_{max,F}$	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.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Residual Noise Level	The ambient noise remaining at a given position in a given situation when specified sources are suppressed to a degree such that they do not contribute to the ambient noise level ($L_{Aeq,T}$)
Specific Noise Level	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source (the noise source under investigation) over a given time interval ($L_{Aeq,T}$)
Rating Noise Level	The specific noise level plus any adjustment for the characteristic features of the noise ($L_{A,r,T,r}$).

APPENDIX B – FIGURES

Figure B1: Unattended Survey Results

