ANNEX I: TERMS OF REFERENCE FOR A NOISE ASSESSMENT

Below TORs are to be applied to development permit proposals submitted to ERA and describe the key components of noise assessment; the stages involved in identifying sources; quantifying emissions; and assessing control requirements.

1. Introduction to the Noise Assessment

The below methodology is to be submitted as part of the method statement prior to undertaking the study, and should be agreed upon between the developers, and ERA, on all relevant noise generating sources and noise sensitive receptors (NSRs).

The collection of baseline data in order to determine the ambient noise level at the proposed area of development are determined via noise monitoring, in accordance with current ISO Standards and British Standards[1] such as:

- ISO 1996-1:2016 Acoustics -- Description, measurement and assessment of sound pressure levels -- Part 1: Basic quantities and assessment procedures
- ISO 1996-2:2017 Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of environmental noise levels
- BS 4142:2014 -- Methods for rating and assessing industrial and commercial sound
- BS 7445-1:2003 – Description and measurement of environmental noise. Guide to quantities and procedures.
- BS 7445-2:1991 -- Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use
- BS 7445-3:1991 -- Description and measurement of environmental noise. Guide to application to noise limits.
- IEC 61672 -- 2013 Electroacoustics - sound level meters Parts 1, 2 and 3
- IEC 61260 -- Ed. 1.0 (1995-08) plus Amendment 1 (2001-09), 1/1 and 1/3-octave Bands (octave-band and fractional-octave-band filters)
- IEC 60942:2018Electroacoustics - sound calibrator

2. Baseline Study

a. The noise monitoring report shall include details of the standards used for monitoring, equipment used including calibration details and calibration certificates, resultant monitoring data, and assessment methods.

b. The study is to be commissioned according to the latest revisions of ISO1996 and the rating of operational noise affecting residential areas shall be according to BS4142:2014.

c. The study should include baseline noise survey of sensitive receptor sites, noise impact on site sensitive receptors including day background levels.

d. The baseline noise monitoring study for the operational assessment, as proposed by the commissioned consultant should address the following issues:

e. Maintenance and field calibration checks: The monitoring shall be performed exclusively using a calibrated and accredited type 1 sound level meter, conforming to BS6698/IEC 61672 Class 1. The use of type 2 sound level meters or less is not considered acceptable and will not be considered. The consultant shall ensure that:
   - Prior to the initial data collection and at the end of the monitoring day, all acoustic instrumentation system such as the sound level meters are calibrated, and checked immediately before and after each series of monitoring readings.
   - Results must be within ±1.0dB, otherwise discarded and read again.

f. Measurement locations: The location for monitoring of ambient noise levels should be between:
   - 1.2 and 1.5m above the ground for a single storey development and;
   - Between 1.2 to 1.5m above the proposed internal floor level for each additional storey.

[1] In the case that the consultant proposes to use equivalent standards (ex. European or ISO) that are not covered by these TORs, the assessment methodology to be adopted is to be proposed for the approval of ERA together with the Method Statement.

g. For noise mapping the following microphone heights must be used:
   - 4.0 ± 0.2 m in residential areas with multistorey buildings;
   - 1.2 ± 0.1m or 1.5 ± 0.1 in residential areas with one floor buildings and recreational areas.

h. To minimize the influence of reflections, the monitoring should either be taken under free-field conditions (more than 3.5m from any reflecting surface) or at 1m from the façade of a building and results treated accordingly.

i. When a noise source is incident on a façade, the effect of reflected noise from the façade is generally to increase the "façade level" measured at 1m by 3 dB.

j. Measurement settings
   - The recommended time periods over a twenty-four hour period are categorized in terms of daytime, from 07:00-23:00 ($L_{Aeq,[16h]}$) and night-time from 23:00-07:00 ($L_{Aeq,[8h]}$).
   - A number of different noise indices are used due to the variation of different noise levels and frequency content over time in accordance to BS 4142:2014. Equivalent continuous noise level over a period of time index, $L_{Aeq,T}$ is to be used for measuring the specific sound and the residual sound. For traffic noise, $L_{A10,18h}$ is more widely used and $L_{A90,T}$ is an appropriate noise metric to measure background noise at the noise sensitive receptor or location.
   - When monitoring for a specific noise level at assessment location it should be adjusted over reference time intervals such as a period of 1 hour during the day, $L_{Aeq,1hour}$ and 15min during the night, $L_{Aeq,15min}$.
   - The measurement time interval should be sufficient enough to obtain a representative value of a typical background when the specific noise source will be operating.

k. All noise monitoring results and any derived averages should be rounded to the nearest whole integer, with 0.5 being rounded up.

l. All meteorological conditions and weather effects such as wind speed and direction, temperature gradient, relative humidity and cloud cover, are to be documented in the beginning of each monitoring period and monitoring point location. The following two points shall be considered, where relevant:
   - Measurements should ideally be carried out under dry conditions; when the road surface is dry; and the wind velocity is of up to $2ms^{-1}$. (At this wind speed the noise levels are enhanced by up to 2dB(A) when compared to still conditions).
   - Monitoring should not be performed if wind speed exceeds $5ms^{-1}$ or wind gusts exceed $10ms^{-1}$ or if it is raining as stipulated in ISO standard.

m. The background noise measurements shall be accompanied by a critical listening of all the other noise sources present in the background.

n. Adjustments: Due to certain acoustic features such as tonality, impulsivity and intermittency the inclusion of specific noise level plus any adjustment for the different noise characteristic features, the rating level, $L_{Ar,Tr}$ should be reported in accordance with BS 4142:2014, depending on the subjective assessment made while taking the readings.

3. Construction Noise Study

The study on noise impacts by the use of equipment and machinery during all construction phases are to be evaluated and assessed using Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, or any update thereof, where in particular Annex C and F are to be used for methodology and Annex E for assessment.

The methodology for assessing the impact of construction noise involves predicting the noise levels at the sensitive receptors at the various phases of construction, such as site clearance and demolition, excavation and construction works. Constructional site noise is produced by a wide range of activities including various machinery

and equipment. The character and intensity as well as the location and duration of the use of such machinery will reflect on the noise generated during the various stages of construction.
The noise levels of constructional noise sources can be determined by the method outlined in BS 5228-1 Annex F, where the estimation of noise from sites at the sensitive receptors can be predicted. The equivalent continuous sound level LAeq is used to predict the noise levels at the sensitive receptors. It is established using the A-weighted sound pressure levels at 10m (dB) as obtained from BS 5228-1 Annex C, which provides a sound level data in relation to typical construction site activities, plant and machinery. Correction needs to be made where there is a potential that multiple equipment will be operating simultaneously in order to generate the combined noise from the different noise sources.

A distance adjustment should also be considered to account for the distance of the noise sensitive receptors from the noise source using reference to BS 5228-1 Figure F.2 and also adjusting for soft ground or hard ground. Attenuation, when taking into account screening or reflection can also be considered as long as it is done in accordance with the standard.
This study must detail the particular activities that are likely to give rise to noise; an assessment of how loud they are likely to be at the receptors, and where they exceed levels detailed in BS 5228, the scheme of mitigation that will be put in place should be included.

4. Report

The report shall include the following:

a. A description of the surrounding areas within approx. 1km radius from the site– this shall include identification of the types of activities, whether residential or commercial, roads and other amenities. These shall be location-specific taking into account their location with respect to the site.

b. Identification of the closest noise sensitive receptors – this shall be carried out after assessing the noise levels in the plant's perimeter and in the other locations under normal operating conditions of the plant. The various measurement points shall be identified with a unique code and an analyses of the ambient noise to which each monitoring point is subjected. The consultant, in collaboration with ERA, may seek advice from the Local Council during the selection of the sensitive receptors.

c. A summary of the data obtained after the survey has been commissioned in relation to the noise sensitive receptors identified above shall be submitted.

d. A noise map maybe required both for baseline studies and for prediction showing the sensitive receptor exposure to noise. The maps will be generated using the above highlighted standards.

5. Assessment

The criteria for assessing the significance of construction noise impacts are outlined in BS 5228-1 Annex E.
(i) The ABC method2

The significance criteria for the construction noise study are based on 'The ABC Method' from BS 5228-1:2009. An extract describing this method is provided below.

[2] BS 5228-1:2009 E.3.2

Example Method 1 – The ABC Method

Table E.1 shows an example of the threshold of significant effect at dwellings when the total noise level rounded to the nearest decibel, exceeds the listed value. The table can by used as follows: for the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5 dB. This is then compared with the total noise level, including construction. If the total noise level exceeds the appropriate category value, then a significance effect is deemed to occur.

Table E.1 Example threshold of significant effect at dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23.00-07.00)	45	50	55
Evenings and weekends[D]	55	60	65
Daytime (07.00-19.00) and Saturdays (07.00-13.00)	65	70	75

NOTE1 A significance effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

[B] Category B: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

[C] Category C: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

[D] 19.00-23.00 weekdays, 13.00-23.00 Saturdays and 07.00-23.00 Sundays.

(Source: BS 5228-1:2009, Page119)

(ii) 5dB(A) change method[3]

The 5 dB(A) change method is based upon the premise that a significant effect for public open spaces is deemed to occur, if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more. The criterion is subject to lower cut-off values of 65dB, 55dB and 45dB LAeq for the daytime, evening and night-time periods respectively. The criteria further requires that for a significant effect to occur the total noise level must exceed the pre-construction ambient noise for a duration of one month or more, unless works of a shorter duration are likely to result in significant impacts.
Furthermore, the significance of impact of the constructional noise on the noise climate can be assessed from what is generally accepted in terms of human perception of changes in sound pressure levels. A 3 dB change in sound level is just perceptible as an increase (or decrease) in perceived loudness, a 5 dB change is perceived as a noticeable difference, and that a 10 dB change is perceived to be twice or half as loud.

1. Impact Significance

a. The level of significance is determined in relation to the magnitude of impact together with the sensitivity of the receptor. Different Noise Sensitive Receptors (NSR) can be classified in three levels of sensitivity: High, Medium and Low.

Sensitivity	Description of Sensitive Receptors
HIGH	**Receptors where people or operations are vulnerable to noise,** *such as: Residential, Recreational Areas, Educational Institutions, Hospitals, Homes for the elderly, Places of worship.*
MEDIUM	**Receptors are moderately sensitive to noise, if it causes some distraction or disturbance,** *such as: Offices, Bars/Cafes/Restaurant.*
LOW	**Receptors where distraction or disturbance from noise is minimal**,

[3] BS 5228-1:2009 E.3.3

	such as: Night Clubs, Sports Ground, Factories.

TABLE 9.1: LEVEL OF SENSITIVITY ASSOCIATED WITH VARIOUS SENSITIVE REECPTORS

b. After all noise sensitive receptors have been identified and prioritised according to their level of sensitivity as identified in the table above, the magnitude of the impact is classified as none/negligible, minor, moderate or major according to the noise monitoring study.

Noise Source		Noise level [dB]	Magnitude of Adverse Impact
Industrial or Commercial Noise			
Target Levels	Rating Level – Background Noise level (L_{Ar})-(L_{A90}) < 5dB	>10	Major
		≤10 but ≥5	Moderate
		<5 but ≥3	Minor
		<3 but ≥0	Negligible
		0	No Change

TABLE 9.2: CLASSIFICATION OF MAGNITUDE ON NOISE IMPACT CRITERIA

c. The different levels of significance relating the magnitude of impact with the sensitivity of the receptor are defined below:

Magnitude of Adverse Impact	Level of significance Relative to NSR		
	Low	**Medium**	**High**
Major	Moderate	Substantial	Severe
Moderate	Minor	Moderate	Substantial
Minor	Minor	Minor	Moderate
Negligible / No Change	Minor/Neutral	Minor/Neutral	Minor/Neutral

TABLE 9.3: LEVEL OF SIGNIFICANCE

Where:
Severe environmental significance is associated with the impacts where mitigation is not practical or would be ineffective and could influence the decision whether or not to proceed with the project.

Substantial environmental significance is associated with the effects that are important considerations, which could result in adverse effects if they are not mitigated.

Moderate environmental significance could have an influence on the decision unless it is mitigated.

Slight/Neutral environmental significance will not have an influence on the decision or require modification on the project design or alternative mitigation and noise need not be considered as a determining factor in the decision process.

6. Mitigation for onsite impacts

A summary report of findings from the noise impact study and any remedial action and/or mitigation measures which are to be implemented by the developer in order to reduce impacts resulting from the site of operation

should be included. A number of various ways to control the noise exposure to people should be limited through one of the following designs:

- Sound insulation and facade insulation treatment;
- Containing noise – acoustic screening and barriers around site; and
- Protecting noise-sensitive buildings and areas – improving sound insulation, screening with purpose-designed acoustic barriers.

Noise control at construction site should be assessed for the noise levels, take all necessary actions to eliminate and remove noise sources, put in place measures to control and prevent exposure and review the study and amend control measures in place. If recommendations are to be proposed, then this could be included as a permit condition and the Building Regulations Office or the Planning Authority (PA) should ensure enforcement.
The following is a non-exhaustive list of actions to achieve good site practices:

- Inform potentially noise-affected neighbours about the nature of construction stages and of the proposed timing of the specific works and where practicable any times which are particularly sensitive for neighbours will be avoided in order to reduce complaints.
- All mechanical plant and construction equipment is to be silenced by best practical means including silencing measures such as compressor panels and mufflers should be properly maintained and utilised.
- Noise enclosures should always have all doors or hatches closed when the equipment is in use.
- Avoid unnecessary noise, such as leaving noisy idle machinery operating, shouting, loud radios or excessive revving of engines.
- Stationary equipment such as pumps and generators should be located away from neighbours.