TERMS OF REFERENCE[1]

FOR THE PREPARATION OF A

STUDY ON THE TRAFFIC IMPACT OF DEVELOPMENT

TRAFFIC IMPACT OF DEVELOPMENT

Introduction:

Increases in traffic flows will doubtlessly adversely affect the environment, particularly due to increased emissions of both air pollutants and noise. The aim of these terms of reference is to provide guidance to consultants on the estimation of the impacts of the increase in traffic flows due to a development on both air quality and noise.

For ease of use these terms of reference have been divided into two sections, Section A and Section B. Part A (sections 0 to 4) deals with the estimation of impact on air pollutant levels, while Part B (sections 5 to 11) deals with the estimation of the impact on noise levels.

The consultant is free to decide whether to present two separate reports or else a single report.

PART A: TERMS OF REFERENCE FOR AIR QUALITY

Legal background:

Regulation 29 of S.L. 549.59, grants ERA the power to issue guidance notes on the conduction of Air Quality Studies which are required by any Regulations issued under the Environment Protection Act including the EIA Regulations (S.L. 549.46).

Part II of Schedule 7 to S.L. 549.59 sets the following (legally binding limit values): an annual limit value of 40µg/m^3 for PM_{10}, a daily limit value for PM_{10} of 50µg/m^3 which can not be exceeded on more than 35 calendar days (90.4% of the daily readings in a calendar year should be < 50 µg/m^3), an annual limit value 40µg/m^3 for NO_2 and an hourly limit value of 200µg/m^3, which can not be exceeded more than 18 times per calendar year.

Regulations 19 and 20 of LN 78 of 2010 give ERA the responsibility to ensure that the above mentioned limits are complied with across Malta and Gozo.

0. **Applicability**

These terms of reference are applicable to all development applications irrespective of whether or not it qualifies for an Environmental Impact Assessment, as long as the expected increase in traffic flows due to the operation of the project is ≥ 1000 passenger cars AADT or ≥ 200 HDV AADT.

The Air Quality study shall be conducted as follows:

1. **Content**

The air quality study shall *inter alia* include the following sections:

a) *The relevant details of the proposed development:* This should include an overview of the expected traffic changes when the project is FULLY operational. The report should also include a brief introduction to the sensitivity of the area to increases in traffic flows and changes in air pollution levels keeping in mind the NO_2 levels registered by the passive diffusion tubes (include in ERA's network) sited closest to the site.

b) *Description of the relevant immission standards with reference to S.L. 549.59.*

c) *The assessment methods*: This section shall include any relevant details on the methods used in order to monitor the base line levels of NO_2 and PM_{10}, including any proof of

equivalence to the reference method(s) as applicable (see 2.i and 2.n below). The section shall also include a part outlining the core details of the model (including version number) being used in order to predict the impact of the development. The consultants shall also include details on all the input data used and its source, including features of the traffic flows used, speeds, apportionment by vehicle type etc.

d) *Site selection*: This section shall include the considerations made by the consultants in the selection of the monitoring site. The consultants shall also show how the selected site matches the site selection criteria in Annex I and the additional criteria Section 2 paragraph k). Prior to the commencement of the monitoring campaign the consultants shall together with the method statement include a map with the GIS location of the sampling point. The map shall include any measurements showing that the selected site complies with points v), vi), vii) and ix) of Annex I.; the identification of any sensitive receptor within a 3km radius as well as any available traffic counts for any thoroughfare within this radius. The monitoring campaign cannot start unless the site has been approved by ERA. The rationale behind the selection of the sampling site shall be clearly outlined explaining how the site meets all the site selection criteria especially the criterion in Section 2, paragraph k).

e) *Model verification*: Model verification involves a comparison between the predicted and the measured values for both PM_{10} and NO_2. Any errors between modeled and measured values should be adequately corrected. In addition consultants are expected to include estimates of the uncertainties in the traffic flows, vehicle emission factors and background concentrations. Any modeled concentrations should include a cumulative sensitivity analysis for these uncertainties (the effect of each uncertainty should be clearly outlined). The limitations of the model should be clearly stated e.g. the software's inability to model dispersion of air pollutants if the air flow is affected by trees or the inability to model pollutant concentrations in street canyons.

f) *Identification of sensitive receptors*: The consultants will be required to identify the sensitive receptors within 3km radius around the site. Sensitive receptors include schools, retirement homes, residential units, hospitals, etc.

g) *Description of the baseline conditions*: This section should details on location of the points at which the air quality monitoring was carried out, the reason for which this particular site was used, the sampling period, data capture, the scale up factors provided by ERA and if possible a break-up of the base line levels of the pollutant by the source.

h) *Assessment of impact*: Results of the modeling for the "with development" scenario should be clearly set out in tables and also through the use of contour maps (which shall include the sensitive receptors identified in e) above), this should be compared to the "without development" scenario with respect to both the table and the contour map. The comparison between both scenarios shall also be applied to each of the sensitive receptors identified in e) above.

i) *Determination of the significance of the impact*: The table in section 4 (and the tool made available through the ERA website) shall be used for each of the sensitive receptors identified in e) as well as for the modeled concentrations at the site where the monitoring was carried out.

j) *Cumulative impacts*: If in the area there are other planned developments, which have already been granted development consent then the contribution of these developments should also be considered at a point in the future when these are fully operational.

k) *Mitigation measures*: If the effect of the project is substantially adverse or worse, then the report shall include any mitigation measures, which have been identified and, which will reduce the impact of the project to at least slightly adverse. Non-quantifiable measures will not be expected.

l) *Summary of the report*: The report should be written in clear, concise, grammatically correct English. If the English of the report is unacceptable, the report shall be sent to the consultants for correction and ERA will not take any responsibility for any delays in the process.

2. **Baseline Studies**

a) The baseline levels of PM_{10} and NO_2 shall be established through *in-situ* monitoring;

b) Baseline levels of PM_{10} shall be determined using the reference method (EN 12341:2014) for the determination of PM_{10};

c) The consultants should use the reference method for the sampling and measurement of PM_{10};

d) The design criteria for the samplers shall be as per Annex B to the said standard and shall be as per Section IV of Annex IX: EN 12341: 2014;

Inlet Design	Flow rate		Filters
See Section 5.1.2 and Annex A of EN 12341:2014	To a nominal value of 2.3 $m^3.hr^{-1}$ see Section 5.1.5 of EN 12341:2014	The instantaneous value of the flow rate shall be kept within 5% of the nominal value. The volumetric flow rate averaged over the sampling period shall be within 2% of the nominal value, see Section 5.1.5	Circular: such that the diameter of the exposed area through which the sampled air passes is between 34mm and 44mm.

Figure 1.1 design criteria for the samplers.

e) The resolution of the balance used for the weighing of filters sampled using an LVS shall be at least 10 µg, Section 5.2.2 of EN 12341:2014;

f) The filters should be conditioned for at least 48 hours (Section 6.2 of EN12341:2014) at 50% relative humidity (+ or - 5%) with an uncertainty of ≤ 2% RH and at 20 ºC (+ or - 1 ºC) with an uncertainty of ≤ 0.2 ºC, according Table 2, Section 5.2 of EN12341:2014.

g) The filters should be weighed at least twice for concordance (the difference between successive readings shall ≤ 40µg, Section 6.2 of EN12341:2014) with a time lag of at least 12 hours between the two weightings;

h) Flow rates are at ambient volumes not at normalised volumes. The weighing shall take place in the same climate controlled room at the same environmental conditions as in f);

i) Consultants can use alternative sampling and measurement methods if they demonstrate to ERA's satisfaction, equivalence to the above mentioned method under the Maltese air pollution climate. Equivalence shall be determined using the European Commission's method for the determination of equivalence; any other method shall be deemed unacceptable. ERA will accept certificates of equivalence issued by third parties, which have been based on the method herein;

j) Compliance with non-European standards does not satisfy the requirements above;

k) Regarding the siting of the sampler/diffusion tube, the consultant shall submit a method statement indicating the location of the sampler/diffusion tube. The sampling point(s)

should not be within the site to be developed or exactly adjacent to it, but should be sited at a location representative of the thoroughfare on which the highest traffic impacts (due to the project) are expected. In addition the consultant is obliged to use all the criteria in Annex I to determine the sampling location. In addition the ERA may at its discretion ask the consultant to change the location of the sampler;

l) The sampling time shall be no less than 6 weeks and extendible by a further 3 weeks depending on the nature of the case and the consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by ERA to the consultant;

m) The consultants shall discard readings influenced by Saharan dust intrusions. These episodes are characterized by a marked spatial consistency, demonstrated by concomitant peaks in the levels of PM_{10} (and $PM_{2,5}$) across the Maltese Islands (see Figure 1 below). The consultants shall use this in conjunction with following two tools to confirm the occurrence of these episodes a) MACC ensemble and b) HYSPLIT back trajectory model.

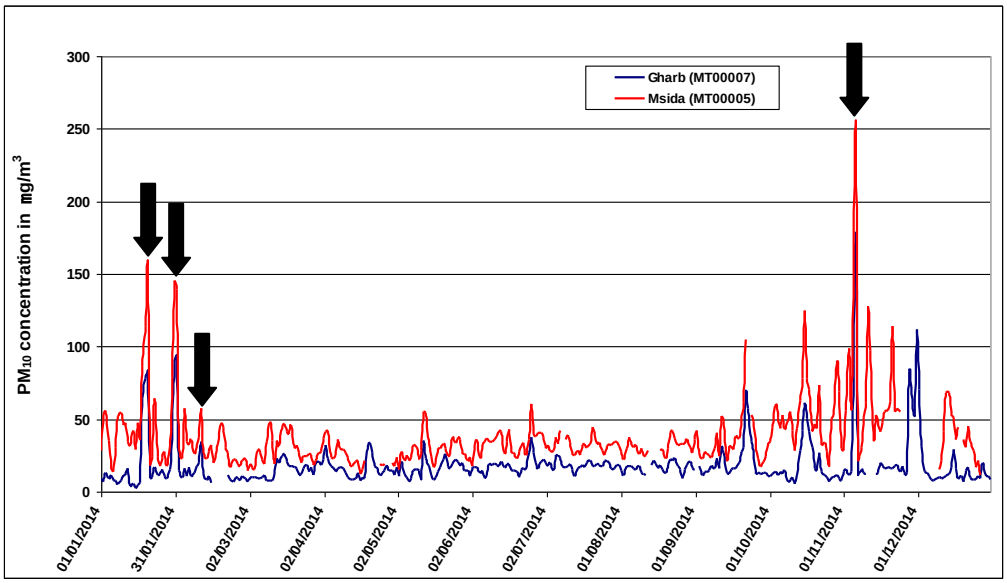

Figure 1: Comparison of the PM_{10} levels in Għarb (blue) to the PM_{10} levels in Msida (red) measured in 2014. The black arrows show some of the Saharan events throughout 2014.

n) The PM_{10} dataset shall in no case consist of <42 or <63 (depending on whether the baseline monitoring period has been set for 6 or 9 weeks) daily readings, excluding any discarded readings.

Baseline levels of NO_2.

o) Baseline levels of NO_2 shall be determined using EN 14211:2005. The consultant may use passive diffusive tubes if it is shown that the latter are equivalent to the reference method.

p) If the consultant opts for passive diffusion tubes, he shall forward at least 1 article in a peer reviewed journal e.g. Pfeffer *et al.* (2010) – *Gefahrsoffe-Reinhalt der Luft*: *70,* 500-506, which shows that the equivalence of these tubes has been demonstrated for field trials (not exposure chambers) in at least 1 EU Member State. Equivalence should preferably, also have been demonstrated in Malta. The field trial shall include the comparison of at least 40 individual measurements taken throughout a whole calendar year. Equivalence shall be determined using a modification of European Commission's method for the determination of equivalence for PM_{10}; any other method shall be deemed unacceptable

q) The sampling point for NO_2 shall be the same as for PM_{10}.

r) The sampling time shall be identical to the one for PM_{10} (i.e. no less than 6 weeks and extendible by a further 3 weeks depending on the nature of the case). The consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by ERA to the consultant.

Annualisation of the 6 (or 9) week averaged values for PM_{10} and NO_2.

s) The factor in l) and p) above shall be based on the use of the following equation (adapted from LAQM TG(16), April 2016 version:

$$CAA = \frac{p_{y+1}^{x\ weeks}}{p_{y}^{x\ weeks}} \times P_{y}^{52\ weeks}$$

Where:
CAA is the corrected annual average;

$p_{y+1}^{x\ weeks}$ *is the concentration of NO_2 or PM_{10} measured by the consultants throughout the 6 (9) week (baseline) monitoring period;*

$p_{y}^{x\ weeks}$ *is the concentration of NO_2 or PM_{10} measured throughout the same 6 (9) week monitoring period of the preceding year at a comparable ERA fixed station; and*

$P_{y}^{52\ weeks}$ *is the annual average of NO_2 or PM_{10} measured at the comparable ERA fixed station.*

Traffic Counts.

a) The consultant shall also take traffic counts at the main junctions near the monitoring site. The number and location of the counters are to be approved by ERA, (unless longer term traffic counts are already available).

b) The traffic count shall take into consideration the vehicle type and the legislation class.

c) The consultant shall use an appropriate model in order to scale the traffic counts obtained during the 6 (or 9) week period to AADT.

3. **Modeling**

a) Once the baseline levels have been obtained the consultant shall determine the impact of the project on air quality through dispersion modeling.

b) The following models are deemed acceptable by ERA:
IMMIS^{em}
BREEZE Roads.
ADMS-Urban

c) The model used should use the logic outlined by e) below,

d) The consultant shall use exclusively the emission factors in the latest version of the Handbook of emission factors for road transport emissions (HBEFA v 3.2). The average age of the Maltese vehicle fleet shall be taken as 13 years.

e) The use of other emission factors is not acceptable.

f) The consultant shall estimate the ambient background levels for both NO_2 and PM_{10}. The approach in Figure 2 below shall be deemed acceptable for both pollutants.

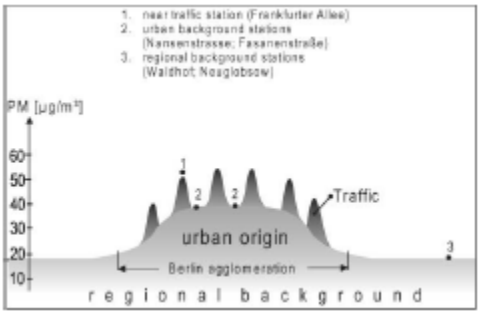

Figure 2: Horizontal profile for PM_{10} concentration, Lenschow *et al.* (2001) – *Atmospheric Environment 35,* 29-33.

g) The rural background can be captured through the use of the EMEP or LOTOS-EUROS model at a resolution of 50km × 50km (The GAINS model might have to be used for emissions data for the EU), the urban background can be captured through the use of a model such as CHIMERE at a resolution of 7km × 7km.

h) The predictions of the model shall be assessed by comparing the modeled data to the monitoring data provided by the baseline studies. The modeled data must not deviate by more than ±20%.

i) Other methods can be used in order to determine the background levels of NO_2 and PM_{10}, including statistical methods aimed at deriving "horizontal profiles" similar to the ones in Figure 1 (see e.g. Gómez-Losada et al., 2016 – *Atmospheric Environment 127*, 255-261) and based on a full year's dataset, interpolation of data from the nearest ERA diffusion tubes, etc.

j) The consultant should clearly explain the rationale behind the determination of the background levels.

k) The consultant shall use the model to project the annual PM_{10} and NO_2 levels into the future, when the project is fully operational taking into account the cumulative impact of projects in the area, which have been granted development consent.

l) The consultant shall model two distinct scenarios: A) without the project and B) with the project.

m) Results shall be displayed as a colour-coded contour map with the modelled annual concentrations of NO_2 and PM_{10} as well as the calculated 90.4^{th} percentiles for the daily PM_{10} levels (calculated using the equation in q) within a 3km radius and especially at the sensitive receptors in point 1e. The position of the sensitive receptors shall be clearly labeled.

n) For the annual averages of NO_2 and PM_{10} as well as for the 90.4^{th} percentile of the PM_{10} levels, the contour maps shall show the situation with the scheme and without the scheme.

o) Contour plots for the 90.4^{th} percentile of the PM10 levels shall include the error in the prediction of this value, which shall be calculated using the equation in q).

p) For the three criteria above the consultants shall also draw colour-coded contour maps expressing the difference in the annual levels/90.4th percentile, between the two scenarios (with and without the scheme) in terms of the significance criteria in 4 b) and 4 c).

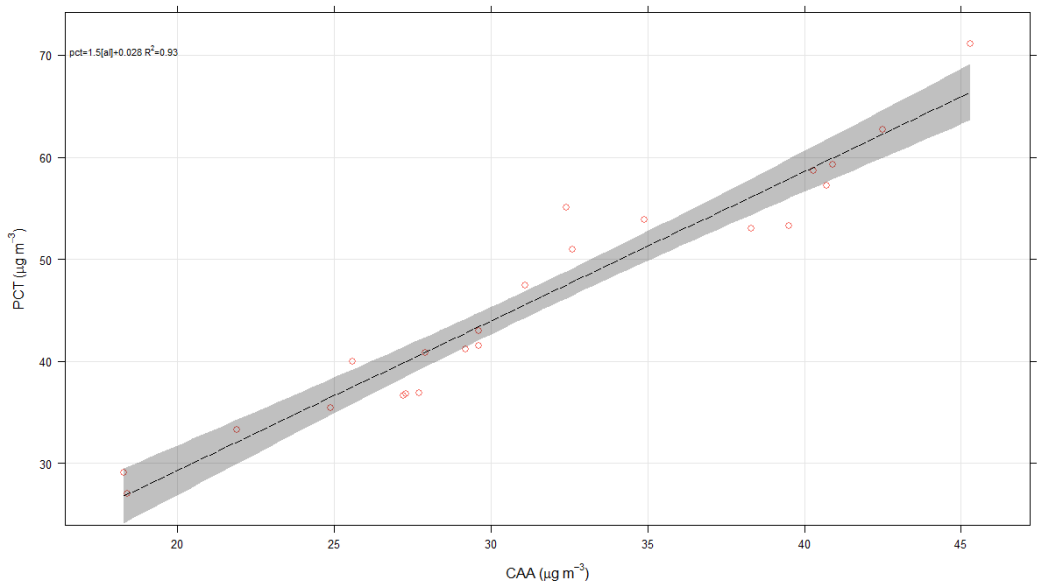

Figure 3: Plot of CAA vs PCT
see e.g. Querol *et al.* (2004) – *Journal of Aerosol Science 35.9*, 1151 – 1172.

q) The consultant shall calculate the baseline of the 90.4th percentile of the daily PM_{10} using the following equation:

$$PCT = (1.46 \times CAA) - 0.03$$

Where CAA (in µg/m^3) is the average of the 6 (or 9) week monitoring period and corrected to an annual average using a factor, which shall be determined by ERA, PCT is the 90.4th percentile of the daily PM_{10} averages in µg/m^3. The equation above will be modified on a yearly basis by ERA.

r) If PCT > 50 µg/m^3 then it is likely that the site is not in compliance with the 90.4th percentile criterion.

s) The consultant shall also use the modeled annual levels for PM_{10} (AA) to calculate the PCT due to the project using the same equation as in n) but substituting AA for CAA.

t) For scaled up annual averages (CAA) <29µg/m^3 the consultants will not be obliged to analyse for compliance with the 90.4th percentile criterion.

u) For NO_2 the consultant shall assume that the annual mean is always exceeded before the allowed number of hourly exceedances.

v) Any assumptions must be clearly stated by the consultant.

4. **Significance Criteria**

a) The following criteria of significance (adapted from IAQM's Planning for Air Quality Guidance, January 2017 version) shall be used by the consultant to determine the significance of the impact at all sensitive receptors and at any point within the 3km radius at which the impact of the project on traffic increases is the highest.

b) A significance criteria tool shall be made available on the ERA website, for guidance and interpretative purposes.

c) For annual levels of NO_2/PM_{10} in $\mu g/m^3$.

		Change in the annual NO_2/PM_{10} (dAA) levels due to scheme ($\mu g/m^3$).			
		dAA ≤ 0.4 $\mu g/m^3$	0.8 $\mu g/m^3$ ≤ dAA ≤ 2.0 $\mu g/m^3$	2.4 $\mu g/m^3$ ≤ dAA ≤ 4.0 $\mu g/m^3$	dAA > 4.0 $\mu g/m^3$
CAA for NO_2/PM_{10} ($\mu g/m^3$)	CAA ≥ 44$\mu g/m^3$	MODERATE	SUBSTANTIAL	SUBSTANTIAL	SUBSTANTIAL
	43.6 $\mu g/m^3$ ≤ CAA ≤ 41.2 $\mu g/m^3$	MODERATE	MODERATE	SUBSTANTIAL	SUBSTANTIAL
	40.8 $\mu g/m^3$ ≤ CAA ≤ 38.0 $\mu g/m^3$	SLIGHT	MODERATE	MODERATE	SUBSTANTIAL
	37.6 $\mu g/m^3$ ≤ CAA ≤ 30.4 $\mu g/m^3$	NEGLIGIBLE	SLIGHT	MODERATE	MODERATE
	CAA ≤ 30 $\mu g/m^3$	NEGLIGIBLE	NEGLIGIBLE	SLIGHT	MODERATE

d) For compliance with the 90.4th percentile criterion for PM_{10}.

		Change in the PCT (dPCT) due to scheme ($\mu g/m^3$).			
		dPCT ≤ 0.5$\mu g/m^3$	1.0 $\mu g/m^3$ ≤ dPCT ≤ 2.5 $\mu g/m^3$	3.0 $\mu g/m^3$ ≤ dPCT ≤ 5.0 $\mu g/m^3$	dPCT > 5.0 $\mu g/m^3$
PCT ($\mu g/m^3$)	PCT ≥ 55$\mu g/m^3$	MODERATE	SUBSTANTIAL	SUBSTANTIAL	SUBSTANTIAL
	54.5 $\mu g/m^3$ ≤ PCT ≤ 51.5 $\mu g/m^3$	MODERATE	MODERATE	SUBSTANTIAL	SUBSTANTIAL
	51.0 $\mu g/m^3$ ≤ PCT ≤ 47.5 $\mu g/m^3$	SLIGHT	MODERATE	MODERATE	SUBSTANTIAL
	47.0 $\mu g/m^3$ ≤ PCT ≤ 38.0 $\mu g/m^3$	NEGLIGIBLE	SLIGHT	MODERATE	MODERATE
	PCT ≤ 37.5 $\mu g/m^3$	NEGLIGIBLE	NEGLIGIBLE	SLIGHT	MODERATE

e) Whenever the impact of the project is determined to be "negligible" no further action will be required from the developer.

f) If the impact of the project is classified as "substantially adverse" then ERA will not recommend approval unless the project is modified in such a way (including scaling down) that the significance of the impact is measurably lessened to at least "slightly adverse". In this case a green travel plan will not be considered as sufficient.

g) If the impact of the project is "moderate adverse" then the developer will be asked to modify the project. The modifications can include a green travel plan which has to include specific, measurable[2] and achievable objectives together with their respective implementation time-frames. The developer will be asked to finance at least in part, the implementation of the green travel plan. The implementation of the plan will have to be audited and eventually updated by the developer on a periodic basis. If the green travel plan does not lower the significance of the impact then the developer will we asked to take additional measures, which may include scaling-down the project.

h) If the impact of the project is slightly adverse then the developer will be asked to consider alternatives, which will lessen the impact of the project.

[2] The term measurable in this context means that the green travel plan shall quantify the reduction in the pollutant levels (in $\mu g/m^3$), over the scenario leading to the classification of the impact as "moderately adverse".

Current and predicted traffic noise levels are greatly influenced by the volume of traffic and distance from the source. Changes in noise climate are associated with changes in traffic flows where traffic is free flowing at speeds of at least 50kph and more than 1,000 vehicles per hour (vph). When this is not the case the IEMA[3] guidelines provide a useful estimate of what could be the likely change in traffic noise levels from the proposed development. The higher the existing level of traffic, the greater the increase in traffic that is required to produce a given noise change. In terms of human perception of changes in sound pressure levels, indicates a 3dB change in sound level is just perceptible in terms of an increase (or decrease) in perceived loudness, a 5dB change is perceived as a noticeable difference, and a 10dB change is perceived as being twice or half as loud.

5. **Applicability**

a) In order to determine whether the proposed development shall give rise to an increase in noise level due to operational traffic, the potential increase in peak traffic needs to be identified (Peak Traffic Forecast).

b) The increase in traffic will have an influence on the existing noise climate. Typically, a halving or doubling of flow produces a 3dB change in noise levels, (The Institute of Environmental Management and Assessment UK, IEMA, Guidance Notes No I, Guidelines for the Environmental Assessment of Rod Traffic).

6. **Introduction to the Noise Assessment**

a) The methodology below should be submitted with the method statement prior to undertaking the study and should be agreed between the developers (or consultants acting on their behalf) and ERA. The study should focus on the effect of increased traffic flows on the noise levels at the relevant sensitive receptors.

b) 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 such as:

- ISO 1996-1:2016 Acoustics -- Description, measurement and assessment of environmental noise -- Part 1: Basic quantities and assessment procedures
- ISO 1996-2:2007 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
- CRTN – Calculation of Road Traffic Noise, Department of Transport (UK), 1988
- 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 -- 2003 Electroacoustics - sound calibrator

[3] The Institute of Environmental Management and Assessment (IEMA) Guidance Notes No I *Guidelines for the Environmental Assessment of Road Traffic*

7. **Base line 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, 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 and night background levels.

d) The 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

g) For noise mapping the following microphone heights must be used:
- 4.0 ± 0.2 m in residential areas with multi-storey 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 facade 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) For road traffic, generally the microphone should not be less than 4m but not more than 15m away from the edge of the carriageway. The microphone should be pointing vertically upwards (grazing incidence).

k) 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, $L_{A10,18h}$ (L_{A10} measurements each hour from 0600 – 2400) 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.

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

m) 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 stipulate in ISO standard.

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

o) 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.

8. **Noise Impact prediction**

a) The baseline and future noise levels shall be estimated using the procedures set out in the Calculation of Road Traffic Noise (CRTN). These use the L_{A10} noise index, which corresponds to the arithmetic mean of the noise level exceeded for 10% of the time; typically one hour or 18hours (18 sets of measured $L_{A10,(1hr)}$ and $L_{Aeq,(1hr)}$ over the course of 18 hour period).

b) Road traffic noise may require two separate considerations: day-time: $L_{Aeq,16hrs(0700-2300)}$ and night-time noise: $L_{Aeq,8hrs(2300-0700)}$.

c) For the noise levels to be in terms of L_{Aeq} over a 16 hour period, an approximate conversion between L_{Aeq} and L_{A10} as estimated from CRTN is given by:

$L_{Aeq,16hr(0700-2300)} \approx L_{A10,18hr(0600-2400)} - 2dB$
And; $L_{A10(1hr)} = L_{Aeq(1hr)} + 3dB$

d) For heavy traffic flow roads, it is usually the case that $L_{A10,1hr}$ is 1dB higher than an average 18hr value, however this depends on the nature of the traffic**.**

9. **Report**

a) The report shall include the following:

- A description of the surrounding areas within a 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.

- Identification of the sensitive receptors with respect to additional noise due to increased traffic flows – 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 to. The consultant, in collaboration with ERA, shall seek advice from the Local Council during the selection of the sensitive receptor.

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

- Impact assessment of traffic noise on the sensitive receptors – this shall include an assessment according to the guidelines BS 4142:2014, ISO1996, ISO9613, ISO 8297: 1994, ISO 3744: 1995 and ISO 3746:1995; and any revision thereof.

- 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.

10. **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**, *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 level [dB]	Magnitude of Adverse Impact
Road Traffic (Change in Noise level)			
Target Levels	Forecast – Existing Traffic Noise level	>5	Major
	< 3dB	≤5 but ≥3	Moderate
		<3 but ≥1	Minor
	Day Time: $L_{Aeq[16hrs(07:00-23:00)]}$	<1 but ≥0	Negligible
	Night Time: $L_{Aeq[8hrs(23:00-07:00)]}$	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.

11. **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.

ANNEX I

This Annex is related to Air Quality Studies only.

Site selection Criteria mention in Section 1 d) and in Section 2 k).

i. PM_{10} samplers shall sited at least 500m from:
   a) dust piles;
   b) construction/demolition/excavation sites & quarries;
   c) dirt tracks;
   d) un-asphalted surfaces;
   e) surfaces which are visibly covered with dust; and
   f) any other surface or activity likely to lead to the entrainment of dust

   .

ii. There shall be absolutely no bends in between the PM_{10} sampling head/sampling inlet for NO_2 and the analyser.

iii. The height of the PM_{10} sampling head/sampling inlet for the NO_2 analyser/NO_2 passive diffusive tube shall be ≥1.5m and ≤ 4m above the ground.

iv. For active samplers, the exhaust outlet shall be positioned in such a way that recirculation of the exhaust air to the sampling inlet is avoided.

v. The distance of the PM_{10} sampling head/sampling inlet for the NO_2 analyser/NO_2 passive diffusive tubes from the edge of any road junction shall be ≥ 25m.

vi. The PM_{10} sampling head/sampling inlets for the NO_2 analyser/NO_2 passive diffusive tube shall be placed at ≤ 10m from the kerbside.

vii. The flow around the PM_{10} sampling head/sampling inlets for the NO_2 analyser/NO_2 passive diffusive tube shall be unrestricted, without any obstructions in the vicinity of the sampler i.e. free in an arc of at least 270°.

viii. The PM_{10} sampling head/sampling inlets for the NO_2 analyser/NO_2 passive diffusive tube shall in no case be at < 0.5 from the nearest building.

Note: The selection of the site is solely the consultants' responsibility. ERA will not waive the requirement for in situ monitoring due to erroneous readings resulting from poorly chosen monitoring sites. The 6 (or 9) week monitoring period will apply regardless of any time constraint the consultants might have. ERA will therefore not assume responsibility for any delays caused by this issue.