



GUIDELINE FOR TRAFFIC NOISE ASSESSMENT CRITERIA FOR EXPRESSWAYS



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PREFACE

Two expressways are operated and a few expressways are being constructed while some expressways have been planned to put in the expressway network of the country. The expressway projects focus to achieve the effective public transport system for the country targeting improvement of the social well-being while achieving the sustainable development goals of the country.

Noise emanating from construction and operation of expressways is well known environmental problem worldwide because it is continuously affected and created nuisance to nearby human settlements, generally. Sri Lanka has experienced on the noise issue on construction and operation of expressways, especially when they fall through dense human settlements.

It was a requirement to have a set of standards which could be used for designing of environmental friendly and sustainable expressways, preparation of proper environmental management plan, monitoring to get understand the exact noise levels, and using for legal requirements. This guideline aims to fulfill the requirements in scientific and systemic manner.

Mr A S Pannila, Additional Director General (Technical Services) of the Industrial Technology Institute and a leading Acoustic Scientist with hands full of practical experiences in the field provided technical consultancy for preparation of the guideline, and the Central Environmental Authority would like to acknowledge his invaluable service for preparation of the Guideline. Stakeholder organizations supported for the preparation of the guideline are acknowledged and names of the stakeholder organizations are listed in the Appendix.

The Central Environmental Authority is in the view of upgrading this guideline into regulations, once acquiring hands on experience on implementation of the assessment criteria and limits set out in the guideline.

Any constructive comment, opinion or review on the guideline or a component of the guideline is welcomed and be kindly requested to send such comment, opinion or review to the following address for future developments.

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GUIDELINE FOR TRAFFIC NOISE ASSESSMENT CRITERIA FOR EXPRESSWAYS

1. Scope

This document presents guidance and recommendation for traffic noise assessment criteria for planning, construction and operation of expressways in Sri Lanka.

1.1. Definition of Expressway

For the purpose of this guideline the expressway is defined as follows;

Expressway is a motorway especially planned for regulated high-speed traffic, having necessary intersections and interchanges, traffic flow ingress and egress controlled, providing unhindered traffic flow, free of at-grade crossings, and separation of opposing traffic with minimum two lines for a direction.

Note:

However, provided that the Road Development Authority or the ministry of the subject of expressways could have the right to regulate the definition and any valid revision to be made by the Road Development Authority or the ministry shall be affected thereof.

1.2. Definition of Expressway Project

For the purpose of this guideline, the expressway project is defined as follows;

A project that shall be planned, constructed and implemented an expressway.

2. Purposes of the Guideline are:

- 2.1. Application of planning purposes typically by government authorities, projects proponents, and consultants
- 2.2. Noise measurements, monitoring, modeling and prediction in expressway projects for institutions who are involved in
- 2.3. Noise impact assessments, and pre & post compliance verification for Environmental Impact Assessments or Initial Environmental Examinations of expressway projects
- 2.4. Determining a noise disturbance on a quantitative manner and regulatory requirements
- 2.5. Offering an introductory treatise in expressway noise control

3. Validity of the Traffic Noise Assessment Criteria

- 3.1. This guideline only applies to expressway projects which were evaluated after year 2017 for environmental compliance.

- 3.2. Noise assessment criteria given in this guideline can be applied only for existing noise sensitive receivers at the time of announcement of the new expressway project. The time of announcement of the new expressway project means the date of the final approval of the Environmental Impact Assessment or Initial Environmental Examination, unless otherwise specified by the Road Development Authority.
- 3.3. This guideline could not be applied to new noise sensitive development, which has gained development consent after announcement of new expressway project.
- 3.4. It is the developers' responsibility to ensure the new development is designed with appropriate consideration of noise impacts due to existing expressway operation.

Note:

However, provided that the Road Development Authority can voluntarily assess complaints receiving against to any expressways evaluated in prior to 2017 using the criteria and permissible levels specified in this guideline.

4. Noise Limits

Noise assessment limits are based on either of the followings, depend on the circumstances.

- 4.1. An absolute limit given in this guideline is based on the average level of noise which should not be exceeded in a specified time period
- 4.2. A relative limit is based on the permitted increase in noise level with respect to the background noise level

TABLE 1 : ROAD TRAFFIC NOISE ASSESSMENT CRITERIA FOR RESIDENTIAL LAND USE

Assessment Criteria dB (A)	
Day (6.00 am - 9.00 pm)	Night (9.00 pm - 6.00 am)
61 LAeq (15 hours) and 63 LAeq (1 hour)	57 LAeq (9 hours) and 59 LAeq (1 hour)

TABLE 2 : ROAD TRAFFIC NOISE ASSESSMENT CRITERIA FOR COMMERCIAL LAND USE

Assessment Criteria dB (A)	
Day (6.00 am - 9.00 pm)	Night (9.00 pm - 6.00 am)
63 LAeq (15 hours) and 65 LAeq (1 hour)	58 LAeq (9 hours) and 60 LAeq (1 hour)

TABLE 3 : ROAD TRAFFIC NOISE ASSESSMENT CRITERIA FOR NON-RESIDENTIAL NOISE SENSITIVE LAND USES OTHER THAN RESIDENTIAL AND COMMERCIAL LAND USES

Existing noise sensitive land use	Assessment criteria dB (A), (when in use)	
	Internal level	External Level
Schools and educational institutions (class rooms)	48 LAeq (1 hour)	63 LAeq (1 hour)
Buddhist temple, Hindu temple, Church or Mosque	45 LAeq (1 hour)	63 LAeq (1 hour)
Hospital wards	43 LAeq (1 hour)	-
Hospital other areas	-	63 LAeq (1 hour)
Court House and library	43 LAeq (1 hour)	63 LAeq (1 hour)
Authorized Child care centers, aged care centers, physical/ mental handicap care centers	48 LAeq (1 hour)	63 LAeq (1 hour)
Open Space – Passive Use (eg. Parkland, forest reserves)	-	65 LAeq (1 hour)
Open Space - Active Use (eg. Sports grounds, golf grounds, walking tracks)	-	65 LAeq (1 hour)

Note: In case of background noise is higher or marginal to relevant noise assessment level, adding +3dB (A) is allowed subject to following conditions:

- a) External Level should not be higher than 72 LAeq (1 hour)
- b) Internal Level should not be higher than 58 LAeq (1 hour)

5. Locations where noise Assessment Criteria Apply

The locations to be selected for assessment against the criteria are described in Table 4.

TABLE 4 : ASSESSMENT LOCATIONS FOR EXISTING LAND USE

Assessment Type	Assessment Location
External noise levels at residencies	The noise level should be assessed at 2.5 meters from the façade/room and at a height of 1.5 meters from the floor (Note 1).
Noise levels at multi-level residential/ commercial buildings	The external point of reference for measurement is the floor of the building that is most exposed to traffic noise. This point should be selected at the height of selected floor and 3 meters from the building (Note 2).
Internal noise levels	Noise level at the centre of the habitable room that is most exposed to the traffic noise with openable windows being opened sufficiently to provide adequate ventilation.
External noise levels for other noise sensitive land users	External points should be selected considering area where the typical activities of the land use is being taken in place (Note 3).
Open space: Passive or active use	The noise level is to be assessed at the time(s) and location(s) regularly attended by people using the space. In this regard, regular attendance at a location means at least once a week.

Note 1:

The position has been adopted to provide a relatively accessible measurement location, and will protect the acoustic amenity of both the internal space in the dwelling and external space near the respective façade/room. In case such location is not accessible, a point inside the building could be selected for the assessment with windows open condition. However external level should be considered for assessment criteria.

Note 2:

In case this point is not accessible for noise measurement; point inside the same floor can be selected with the condition of openable windows being opened sufficiently to provide adequate ventilation. In such a situation assessment is based 5 dB (A) less than the relevant external level.

Note 3:

This does not mean that noise levels over the entire property will also meet the assessment criteria.

6. Measurement Equipment

- 6.1. The measurement shall be made with a precision sound level meter which comply with the requirements of the IEC publications, IEC 60942:2017 and IEC 61672-1:2013 or thereafter, and the type of meters in class 1.
- 6.2. The “A” weighting network and ‘fast’ time weighting response shall be used for sound pressure level measurements for equivalent Leq and statistical centile readings.

- 6.3. Measurement for statistical centile levels (L_{90}) and maximum level (L_{max}) shall be made using a sound level meter which is installed with statistical analysis functions, or alternatively computed from continuously monitored instantaneous sound pressure levels using data acquisitions system for the stipulated time period.
- 6.4. The calibration of sound level meter shall be checked and adjusted according to the manufacturer's instructions using standard sound source (sound level meter calibrator or pistonphone) at the beginning and end of each series of measurement.
- 6.5. A wind shield approved by the microphone manufacturer shall be used. Measurements cannot normally be made if the wind speed exceeds 5 m/s. For continuous remote monitoring, the wind speed shall be monitored concurrently with sound levels.

7. Calibration of Equipment

- 7.1. Sound level meters and sound level calibrators which are used for noise measurement should have valid calibration certificate with international traceability.
- 7.2. Maximum valid period for calibration report for sound level meter is 4 years and sound level meter calibrator is 2 years.

8. Requirement of Accreditation

The organization/Institute who measures/monitors the road traffic noise levels should have valid ISO 17025 accreditation status for measurement of environmental noise and background noise.

9. Software for Noise Predictions

Internationally accepted software package should be used in prediction of noise levels. Any accepted software which is used for prediction of noise levels, must be validated with respective in-field measurement in order to noise prediction reflect the actual situation as closely as possible and any difference between the model output and measurement value are known.

Note;

A number of software packages which implement various suits of calculation methods are available including:

Sound PLAN	- Braunstein +Berndt
Cadna A	- Datakustik
Type 7810/Pradiator	- B & K
Traffic noise model	- US Federation Highway administration

The above software packages can accurately implement calculation methods as specified by their developers. This is not an exhaustive list and there are other software as well.

10. Noise Monitoring Procedures

Following noise level descriptors are used as per the noise assessment criteria of this guideline.

- L_{Aeq} (15 hours) - Represents the L_{Aeq} noise levels for the period of 6.00am - 9.00pm
- L_{Aeq} (9 hours) - Represent the L_{Aeq} noise levels for the period of 9.00pm - 6.00am
- L_{Aeq} (1 hour) - Represent the L_{Aeq} noise level for a specific one hour period
- L_{A90} (15 hours) - Represent the background noise level for the period of 6.00am - 9.00pm
- L_{A90} (9 hours) - Present the background noise level for the period of 9.00pm - 6.00am
- L_{A90} (1 hour) - Represent background noise level for a specific one - hour period

10.1. L_{Aeq} (15 hours)

L_{Aeq} (15 hours) is the L_{Aeq} noise level for the period 6.00 am – 9.00 pm. It is recommended that the L_{Aeq} be measured on 15 minutes intervals. The equation is L_{Aeq} (15 hours), logarithmic average of all the individuals L_{Aeq} (15 minutes) values from 6.00 am to 9.00 pm, with first reading was taken at 6.15 am and the last at 9.00 pm.

$$L_{Aeq(15\text{ hours})} = 10 \times \log_{10} \left[\frac{\sum_i^n 10 \frac{L_{Aeq(15\text{ min}),i}}{10}}{n} \right]$$

Where n = number of L_{Aeq} (15 Minutes) values in each assessment period over the measurement period

10.2. L_{Aeq} (9 hours)

L_{Aeq} (9 hours) is the L_{Aeq} noise level for the period 9.00 pm – 6.00 am. It is recommended that the L_{Aeq} be measured on 15 minutes intervals. The equation is L_{Aeq} (9 hours), logarithmic average of all individuals L_{Aeq} (15 minutes) values from 9.00 pm to 6.00 am with first reading was taken at 9.15 pm and the last at 6.00 am.

$$L_{Aeq(9\text{ hours})} = 10 \times \log_{10} \left[\frac{\sum_i^n 10 \frac{L_{Aeq(15\text{ min}),i}}{10}}{n} \right]$$

10.3. L_{Aeq} (1 hour)

L_{Aeq} (1 hour) means the highest 10th percentile hourly A-weighted L_{eq} during the period when the particular class of receiver building/place in use. Alternatively the highest L_{Aeq} (1 hour) value can be used where insufficient data are available to provide a valid 10th percentile value.

10.4. Background noise levels

Background noise level should be measured by using L_{A90} descriptor. L_{A90} (15 hours), L_{A90} (9 hours) or L_{Aeq} (1 hour) should be measured relevant to the noise assessment criteria of the particular land use.

11. Application of the Noise Assessment Criteria for New Projects

Steps should be taken in the following order to apply noise assessment criteria for actual noise mitigation.

11.1. During planning stage of the project

Step 1: Identify the study area, comprising noise sensitive assessment locations within 200 meters from the centre line of the outermost traffic lane on each side of the proposed road.

Step 2: Predicted noise levels (with estimated vehicle count for 5 years and 10 years) at the identified noise sensitive receivers should be calculated using internationally accepted noise prediction software. (Noise prediction should be done using a validated software within Sri Lanka).

Step 3: For each assessment location in the study area where exceedances are identified in step 2, identify feasible and reasonable mitigation measures in following order of priority.

- i. Road design and traffic management
- ii. Road surface type
- iii. In-corridor noise barriers
- iv. Localized noise barriers or at-property treatment

Step 4: Calculate the predicted noise level in step 2 again with the proposed mitigation and make sure the predicted noise levels are within the assessment criteria.

Note:

In the event of In-corridor noise barriers are not effective or not economical, in such situation localized noise barriers or at property treatment could be considered. Localized noise barriers or at property treatment should be designed in consultation with the land user(s) and consent for the design should be taken.

11.2. During the operation of the project.

Step 5: Actual noise measurements should be carried out after one year time from the date of operation of the road. Additional noise receivers (if any) should be identified using this actual noise measurement.

Step 6: Suitable mitigation method should be applied for the receivers who were identified in step 5.

Step 7: Repeat step 5 and step 6 in three year and five year time interval after the date of operation of the road.

Note:

Only existing land users before the announcement of the road will be considered for step 1 to step 7.

Appendix

Stakeholder organizations supported for preparation of the Guideline

1. Ministry of Transport and Aviation
2. Ministry of Megapolis and Western Development
3. National Building Research Organization
4. National Engineering Research and Development Centre
5. Industrial Technology Institute
6. Urban Development Authority
7. Road Development Authority



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