Developing a Railway Noise Model for Sri Lanka

K. Umaluxman and Loshaka Perera

Abstract

Railway noise is a significant environmental concern in many countries, including Sri Lanka. Railway noise pollution is becoming a more pressing issue with the expansion of railway networks and the increasing use of trains for transporting passengers and goods. It differs from road traffic noise, being distinct, rhythmic, and lower in frequency. Railway noise has continued impacts on the passengers during the journey and periodical impacts on the residents and workers who live or work nearby the railway stations and railway lines. Railway noise can have various adverse health impacts, including sleep disturbance, annoyance, cardiovascular effects, and cause hearing damage. The lack of noise-related impairment data highlights the issue, emphasizing the need for more research and attention to noise pollution's impact. Railway noise stems from four main sources: rolling noise, traction noise, aerodynamic noise, and other noise like horn noise and noises which are caused by the irregularities such as joints and switches. Factors like speed, track type, and train condition affect noise generation, while ground, terrain, atmospheric conditions, and urban or rural settings influence noise propagation. Understanding these factors is crucial for creating accurate noise models and effective noise management strategies. Countries employ distinct railway noise models, reflecting diverse approaches to addressing noise in rail systems. Existing noise models often overlook Sri Lanka's unique geographic and locomotive related factors, limiting their effectiveness in addressing railway noise pollution. The country's diverse terrain, from mountains to coastlines, amplifies and alters noise patterns due to sound reflections and refractions. This study is focused on developing a model that can accurately predict railway noise levels incorporating unique elements. Multiple variables influencing railway noise levels were considered in the development of mathematical model. Key factors considered are engine type, train speed, track geometry, sleeper type, environmental conditions, track maintenance, and distance. Because of the extensive nature of the railway network in Sri Lanka, data collection was done in a systematic way considering the key factors like diverse topographies, ground conditions, track formation condition, sleeper type, train types and locomotives. Noise levels measurements adjacent to the railway lines were collected with a noise level meter. Alongside noise readings, relevant data on various factors was gathered. Collected data was pre-processed to remove any outliers or errors, to data normalization, to ensure consistency and comparability. The Central Environmental Authority's rail transit system noise standards specify that the maximum noise level should not exceed 85 dB under various conditions, including residential and commercial areas, as well as day and night times and the equivalent continues noise levels should fall less than or within the range of 55 to 65 dB for compliance. The collected data revealed that the maximum noise levels of the railway lines were higher than 95 dB, surpassing the maximum sound level mandated by the CEA standard. And Survey Department of Sri Lanka states that, there should be no cutting or development of land within a 40-meter distance from a railway line. But there are places in Sri Lanka where we have unauthorized constructions within these limits. As a result, there is a pressing need to identify the noise levels and propose mitigation measures. The expected outcome of this study is to identify the factors which influence the railway noise levels and to

develop a mathematical model which can predict the noise levels near railway lines in Sri Lanka. The model needs to be validated and tested for its accuracy. The mathematical model allows to identify how changes in factors such as engine type, train speed, track geometry, sleeper type, environmental conditions, track maintenance, and distance influence the changes in the railway noise levels. It helps in designing effective noise reduction measures, ensuring compliance with noise regulations, and making informed decisions regarding railway planning and operations. Ultimately, the research outcomes are expected to contribute to a more sustainable and noise-sensitive railway system in Sri Lanka by enhancing the overall noise quality.

Keywords: *Noise levels, Noise model, Railway noise, Mathematical model*

Authors Details;

1. Research Assistant, Department of Civil Engineering, Faculty of Engineering, University of Moratuwa, Sri Lanka ukanagasingam@gmail.com
2. Traffic Engineer, City of Rockingham, Australia. perera.loshaka@gmail.com