Available online at www.elixirpublishers.com (Elixir International Journal)

Applied Mathematics

Elixir Appl. Math. 90 (2016) 37515-37516

ISSN: 2229-712X

Mathematical Model on Noise Pollution

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ARTICLE INFO

Article history:

Received: 2 December 2015;

Received in revised form:

1 January 2016;

Accepted: 6 January 2016;

Keywords

Modeling,

Traffic,

Noise,

Pollution.

ABSTRACT

For many of us, the concept of pollution is limited to nature and resources. However, noise that tends to disturb the natural sythms of life makes for one solid pollutant noise takes place when there is either exercise amount of noise or an unpleasant sound that causes temporary disruption in the natural balance. Large number of vehicle on road produce heavy noise and people get it difficult to get accustomed to that the high noise leads to different health problems like hearing problems, health issues sleeping disorders etc. the present work discusses the fundamentals of acoustics and analysis of vehicular traffic noise. A large number of sets of data were recorded at different dates in a random manner in order to account for statistical temporal variations in traffic flow conditions.

Introduction

Noise can be defined as the level of sound which exceeds the acceptable level and creates annoyance. Frequent exposure to high level of noise causes severe stress on the auditory and nervous system. Extended exposure to excessive sound has been proved physical and psychological damage. Because of its annoyance and disturbance implications, noise adds to mental stress and hence affects the general well being of those exposed to it. The source that affects the most is traffic noise. In traffic noise, almost 70% of noise is contributing by vehicle noise. Vehicle noise is created by engine and exhaust system of vehicles, aerodynamic friction, interaction between the vehicle and road system, and by the interaction among vehicles.Noise measuring devices typically use a sensor to receive the noise signals emanating from a source. The sensor, however, not only detects the noise from the source, but also any ambient background noise. Thus, measuring the value of the detected noise is inaccurate, as it includes the ambient background noise. Many different type of instruments are available to measure sound levels and the most widely used are sound level meters.

Introduction to Vehicular Traffic Noise

Traffic noise will continue to increase in magnitude and severity because of population growth, urbanization, and the associated growth in the use of automobiles. It will also continue to grow because of sustained growth in of vehicles.

Vehicle Noise Sources

It is well established fact that vehicular traffic noise is a major source of community annoyance especially near highway carrying fast traffic. Many people consider the truck noise to be the principal offender.

Rapidly changing population patterns on the national scene and developed public expectancy in terms of environmental effects have generated the requirement to furnish environmental impact statement is the noise that my result from the traffic noise is more complicated due to the facts that highways are not flat, straight or free from natural terrain variation.

A number of factors can influence the traffic noise, whose major sources are noise emission from vehicle, interaction of tyres with road surface, traffic flow conditions and driving habits.

Noise Prediction Models

Traffic noise prediction models are required as aids in the design of highways and other roads and sometimes in the assessment of existing or envisaged changes in traffic noise conditions. They are commonly needed to predict sound pressure levels, specified in terms of (Leq) L10, etc., set by government authorities.

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They are commonly needed to predict sound pressure levels, specified in terms of Leq, L10 etc. Several models have been developed by regression analysis of experimental data from fundamental variables such as traffic flow, vehicle speed, etc.

The noise nuisance was aggravated by the indiscriminate horn blowing, rapid accelerations and overtaking.

Results and discussions

Modeling of traffic noise

Modeling of traffic noise has several uses, including estimating current noise exposure along roadways, assessing the effect of roadway changes, and predicting the performance of noise abatement options. The basic elements of traffic noise modeling are the traffic source levels and the propagation or attenuation of sound between traffic and receiver. Typical source related inputs to traffic noise models are the speed and volume of vehicle types, operating mode of the vehicles and the length of roadway with line of sight to the receiver location. Propagation related inputs include the acoustic characteristics of the ground, the number of lanes of travel, site geometry and topography and the type of geometry of any barriers or buildings present. Most models also consider the

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type of pavement at the site in regard to tyre-pavement noise generation, the prevailing wind and temperature conditions and interrupted traffic flows. There are a number of resources that can be consulted for additional, detailed information about traffic noise prediction methods. To develop road traffic noise a relationship is found between two or more variables and these relationships are expressed in mathematical form. Followings are steps followed:

Step 1

Collection of various parameters for this study as follows. Date & Time, Total vehicle count, T_1, Average Speed, T_2 (kmph), Atm. Temp., T_3 (°C), Surface Temp., T_4 (°C), Equivalent noise level, Leq (dB)Relative Humidity, H (%)

Step 2

Analysis of the collected data using DATAFIT (Version 8.10) to find out the correlation between the various parameters and the noise level. A nominal distribution test is also applied to test the model for its goodness of fit.

Based on the data taken in different days between 6.00A.M. to 6.00 P.M., the data analysis was done using DATAFIT (Version 8.10). The best form of regression equation obtained is given below.

$Leq = 75.58 + 0.0024T_1 – 0.0064T_2 + 0.0469T_3 – 0.00451T_4 + 0.0306H$ ($R^2 = 0.523$)

Where, T_1 = Total vehicle count in both directions,

T_2= Average speed of vehicles in kmph,

T_3 = Average atmospheric temperature in °C,

T_4 = Average Surface temperature in °C,

H = Relative humidity in %, and

R2 = Coefficient of correleation.

This equation can be used for predicting traffic noise in a two lane road.

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