A Review on Railway Noise Pollution and Modeling using Multiple Linear Regressions

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Abstract— Technological advancement has brought many conveniences, but it has also resulted in may hazards. Pollution of various types is one of them. Noise is one of the most undesirable by products of a modern and mechanized life style. Noise is slow poison. Higher exposure to noise may result in variety of biological reflexes and responses. Various types of Traffic model has been developed. Multiple regression analysis method is most widely adopted and satisfactory method to generate noise predicting model.

Key words: Noise, Noise Pollution, Modeling, Multiple Linear Regression, Transportation

I. INTRODUCTION

Technological advance has bought many conveniences, it has also resulted in many hazards. Pollution is one of them. The types of pollution include water pollution, air pollution, noise pollution, soil pollution, etc. [2]

The word noise is arrived from the Latin word nausea. Noise means wrong sound in the wrong place at the wrong time. Noise pollution may be defined as unwanted sound which gets damped into the atmosphere without regarding to the adverse effects it may have. Sound is measured by several complex system, but the best known unit of measurement is the decibel(dB). Noise may cause deafness, nervous, mental disorder, high blood pressure, head ache, insomnia. [7]

Noise pollution is no longer restricted to industrial environments but affects small, medium and large cities all over the world. It is daily reality both in developed countries such as the United States and European nations and in emerging countries such as India, China and brazil. Noise pollution in urban environments comes from numerous sources e.g. sirens, loud speakers, cars, home alarms, trucks, trains, planes, buses, etc.[5]

Area	Category	Limits in dB	
		Daytime	Night time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Area	50	40

Table 1: Noise Level to be maintained (Environmental Protection Rules, 1986)

II. MEASUREMENT OF NOISE

A decibel scale is the standard for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard on the scale account.

A. Equivalent Noise Level:

It is the continuous "A" weighted sound level that is equivalent in terms of noise energy content to the actual instable noise existing at that location over the observation period. It is also explained as the average rate at which energy received by the human ear during the period mentioned.

$$Leq= 10 \log 10 \frac{1}{T} \int_0^T \frac{(t)}{Po} dt$$

It is the noise parameter which is widely in use which calculates a constant level of noise with the energy as varying acoustics noise signal which are measured. The word "A" known as that the A weighting has been include and "eq" describes that an equivalent noise level has been calculated.

III. MULTIPLE LINEAR REGRESSION METHOD

Linear regression is an idea to model the relationship between dependent variable Y and independent variable X. If there is one independent variable than it is known as simple regression. If there are more than one independent variable than it is called as multiple linear regressions.

A general idea of linear regression model is that, the dependent variable Y_i is a straight line function of a single independent variable X_i. The approach of simple linear regression model to multiple linear regression model by $x_i1, x_i2,\ldots,x_ik$ allowing response variable to be a function of k independent variable.

$$Y_i= B_0+B_1x_1+ B_2x_2+\ldots+ B_nx_n+e$$

Where.
B_o= Constant term
B_1 to B_n= Co-efficient relating independent variable.

IV. STUDY OF NOISE POLLUTION ON RAILWAY STATION

Anurag Tiwari et. al.(2013) [1] has studied the noise levels in Amaravati city, India. The differentiation in the level of noise is because of railway crossing, traffic flow, traffic volume data in the peak hours has been studied and represented in the graphical form for different location. The maximum noise was noted during the passage of train through level crossing which was remarkable. On all study locations the noise limits were ranging between 70dB-110dB which was almost 1.5 times higher than permissible limits for commercial zones. The author has suggested some remedial measures to overcome the noise pollution in such growing urban areas.

Paulo Henrique et. al.(2014) [5] has studied on noise annoyance through railway traffic in Brazil. In this study measurements has been taken of noise levels produced by trains passing through residential areas, neighborhoods with and without blowing their horns. Noise maps were calculated indicating noise pollution generated by the trains traffic. In the end of the study it has proved that the majority of resident's survey believed that the rail noise of the train can undervalue their property. The residents were found strongly affected by noise generated by passing trains. It

was conclude that noise is rated as the most serious environmental nuisance caused by railways.

Pranas Baltrenas et. al.(2008) [6] as studied dispersion of railway noise in the environment at paneriri railway station. The noise level produced by trains has been exceeding in 1125-400Hz. The model generated of dispersion of railway traffic to the environment helped to evaluate the impacts of the noise near the railway station. Two noise reduction walls 6m high were installed on both sides of the railway, which would allow reducing the level of noise caused by railway traffic in the living territory to the permissible levels.

Savale P A. (2013) has studied the effects of noise pollution on human being and its control and prevention. He studied that noise was generated by various sources in different ways. The main objective of the study is to know about the various ways of generation of noise, their effects on human, its prevention and control. The author has studied about physiological effects, effects on wildlife, hearing impairment, disturbance on mental health, cardiovascular disturbances, sleep disturbances, impaired task performance, etc. The author gave some remedial measures like public educations, government and NGOs can play significant role in controlling the noise pollution for better future of environment. To reduce noise pollution scientific method are suitable as per his study.

V. Kanakasabai et. al.(2005) [8] has studied the different noise level on Chennai central, Villupuram and Tiruchipalli railway junctions. In this study sound level meter SVAN943A has been used. The study was carried out for 10 days on interval of 15 minutes. The author concluded that during arrival or departure of trains at trains at the platform noise suddenly increased by 27dB from normal level. It also concluded that sudden increase in noise level can cause serious health hazards. Noise level assessed on both railway station were almost same.

V. MODELING OF NOISE POLLUTION USING LINEAR REGRESSION METHOD

Bhaven Tandel (2013) [2] has studied assessment and MLR modeling of urban traffic noise at major arterial roads of Surat city. The study was carried at corridors (i) Kamrej-Varachha corridor (ii) Hazira-Adajan corridors (iii) olapad-Rander corridor (iv) Sachin-Udhana corriodor (v) Kadodara-Sahara corridor (vi) Dumas-Athwa corridor. The study was carried out to generate noise predicting model and to analyze various parameters affecting road traffic noise. It was concluded that the model when validated gives quite satisfactory results. The noise level at all major arterial roads exceed the limit prescribed by CPCB.

Bulent bostanci et. al (2014) [3] has generated the generated the urban noise model by multiple linear regression analysis method. They measured that the noise on the main street in front of the Erciyes University, within five minutes intervals in the morning, evening and at night. Noise values obtained as the results of the studied were assessed were assessed by using interpolation methods and a geographic information system aided road traffic noise model was created. The model was The model was meeting all hypotheses.

E K Manatakis (2011) [4] has studied about the traffic noise of vehicles as main source of urban areas. Control of traffic noise has become matter of a major concert for communities trying to maintain satisfactory environment in which to live and to work. In this study statistical modeling of road traffic in urban areas in order to modeling traffic noise was conducted. Multiple linear regression reveals the most significant factors of traffic noise and functional expansion. The method can be used effectively in traffic noise prediction for related similar projects.

Wai ming to et. al. has studied traffic noise survey in heavy built up urban areas in Hongkong. Noise measurements were carried out on different 18 locations. Numbers of light vehicles, numbers of heavy vehicles were the most affecting parameters which were found. The accuracy of the empirical formula was quantified and were compared to another widely used predicting model,

VI. CONCLUSION

Public noise health has been matter of great concern for all of us noise pollution control is necessary. The noise pollution can be controlled at the source generation itself by reducing the noise level from domestic sectors, maintenance of automobiles, control over vibration, low voice speaking, prohibition of loud speakers.

According to study of the papers noise pollution is one of the most serious issue in industrial areas as well as commercial areas. In future, public participation, government and NGOs can play significant role in controlling the noise pollution.

Noise traffic predicting models have been built and developed using various approaches. The method linear regression modeling is widely adopted. Most of the noise predicting models in India and worldwide have been built using regression modeling. Regression modeling method is very reliable and satisfactory method to generate noise predicting model.

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