ABSTRACT

Development of transportation infrastructure in, metropolitan cities is taking place in a massive way. Many a times, Environmental Impact Assessment (EIA) of these projects is not given due importance. Construction of Flyovers, including of major arterials, operation of Flyways etc. are some of the major transportation infrastructures developed which have significant environmental impact in terms of traffic noise.

Traffic noise has been reported as a major nuisance in many countries of the world. Noise levels are showing alarming rise and infact the levels exceed the prescribed levels in almost all forms of land use zones namely residential, commercial, heavy traffic and even in the silence zones The problem of noise impact due to transportation system is unique among the variety of pollutants in metropolitans' cities in India as unlike air or water pollution, noise leaves no residual evidence to serve as a continuing reminder of its unpleasantness, due to which even though its effects are usually as severe as any other pollutant, noise is often the pollutant with the lowest priority for control. Noise is one of the major environmental pollutants that are being encountered in urban areas. In general noise has three sources (i) operational noise from transportation system (ii) occupational or industrial noise (iii) community background noise. Among these, operational noise from transportation system alone contributes to about 70% of total noise out of which road traffic noise is responsible for 55% of the total noise.. Traffic noise is associated with numerous health problems such as temporary or permanent threshold shift of the hearing mechanism, loss of hearing, psychological strain, mental fatigue, annoyance, headache,

hypertension, damage to heart and various other physico–biological disturbances like changes in digestion metabolism, blood circulation etc . At levels above 130 dB (A) noise can even cause death. These health problems affect the quality of life in urban areas and ultimately the national economy.

Due to rapid urbanization, facilities for human activities are increasingly located near traffic corridors and hence the detrimental effect of traffic noise becomes pronounced. In view of the above, there is a need to establish methods to predict traffic noise in urban areas. The traffic noise in urban areas is characteristically different from the traffic noise observed on rural highways. This characteristic difference in traffic noise requires a different modeling technique. Traffic noise prediction models have been developed in USA, U,K. etc. However these models cannot be used directly for a developing country like India for noise impact assessment. It is therefore imperative that a study on transport related noise pollution be carried out and various strategies for control and reduction of noise pollution be implemented. It is therefore essential to objectively assess the noise impact as a part of EIA of transportation infrastructure developed for metropolitan areas as a case study.

Noise prediction models can be developed on the basis of correlating ambient noise with various traffic parameters i.e. classified traffic volume, stream speed, road geometrics, vehicular emission characteristics etc. These models can be used for prediction of noise level for a proposed transport infrastructure and asses whether the same is within permissible limits or not.

The growing cities have a high level of demand for travel by mechanized modes. Delhi being the capital of the country has shown rapid urbanization which is associated with an alarming vehicular growth. The no of vehicles in Delhi alone

are more than the number of motorized vehicles of Mumbai ,Kolkatta & Chennai put together The number of vehicles have increased from 26.30 lakhs in 1995-96 to 48.30 lakhs in 2005-06 at an annual compound growth of 5.84%Decennial growth rate is substantially higher in case of private vehicles (91.62%) as compared to commercial vehicles.(6.67%).

This research project aims at developing a methodology for traffic noise prediction in Delhi, twenty three locations throughout the capital state have been selected and a detailed study has been made for developing noise prediction models and, abatement strategies for reducing traffic noise related pollution. As an abatement strategy for reducing traffic related noise pollution due to transport infrastructure, principle of noise barriers has also been discussed in the report. A complete methodology for designing noise barriers has been developed which has been implemented by Delhi Public Works Department, (PWD) for the Britannia Chowk Flyover. Studies have also been carried out to observe the changes in noise level due to erection of this noise barrier.

The present thesis has been divided into six chapters. Chapter one deals with the Urbanization trends, Vehicular noise, and its effects on human health, characteristics of Delhi city and a brief introduction to the objectives, methodology & scope of the study.

The Chapter two gives the review of studies related to sound and noise pollution conducted in India and abroad. The chapter mainly deals with study of basic acoustics, noise propagation levels, scales & ratings of sound, the parameters affecting noise pollution, strategies for noise control, noise standards, noise measuring devices, effect of various factors on noise level, noise prediction models and noise barriers.

Chapter three consists of identification of study locations, field data collection, analysis of data and development of methodology. The field study program has been worked out on the basis of identification of locations, details of studies, data collection and analysis of data. The locations are so chosen as to represent the different land use within an urban area like Residential Zone, Commercial Zone, Silence Zone and Heavy Traffic Zone. The studies considered for the development of methodology are traffic volume, traffic speed and traffic noise studies. The study is mainly intended to measure transport noise pollution concentration in urban locations.

Fourth Chapter deals with the development of traffic noise prediction models. The chapter also includes the traffic noise prediction models developed for Delhi City by adopting the Federal Highway Administration (FHWA), USA and Calculation of Road Traffic Noise (CORTN), UK models for local conditions. Traffic noise prediction models developed throughout the world differ in some respects, but overall the methodology is similar. All the noise prediction models consist of evaluating basic noise levels and making series of adjustments to take into account geometrics, traffic flow etc. FHWA and CORTN models are two important models based on this concept. In this thesis, attempt has been made to analyze the data for the development of models similar to FHWA and CORTN. An important input in the noise prediction model has been development of. basic noise emission equations specific to Indian conditions. In this process a detailed study has been made at twenty three locations in Delhi. At the identified locations traffic volume, traffic speed and ambient noise level data has been collected for duration of twenty four hours. Noise levels at all these identified locations have been predicted using FHWA and CORTN models. The analyzed

results are subjected to statistical and regression analysis so as to compare the two models i.e FHWA and CORTN. From the results, it is concluded that FHWA model is more suitable for traffic noise prediction for Indian conditions. Traffic Noise Prediction models were developed for different land use zones in Delhi. Traffic noise prediction models are also recommended for the Delhi City using the modeling approach of FHWA model.

Fifth Chapter deals with the noise abatement measures, noise barrier design considerations and noise abatement strategy for Delhi. A step by step methodology was followed for the design of noise barrier for Britannia Chowk Flyover. Flyover locations are major traffic concentration points. Delhi Government had decided to erect a noise barrier for the Britannia Chowk flyover and it was an opportunity to carryout noise impact studies for this flyover during different phases. Noise Barrier has been designed adopting three approaches i.e. (i) Acoustical Design (ii) Structural Design, and (iii) Aesthetic Design. The traffic noise prediction model developed in this study was used for design of noise barrier. Traffic noise predication model has a sub module that calculates the effect of noise barrier adopting the principle of diffraction. This model uses various traffic and geometrics of transport infrastructure as input and provides height of the barrier as output. For a flyover, noise barrier is embedded over the crash barrier on either side of the flyover. The height of crash barrier is also effectively used for noise reduction in this manner. Height of noise barrier over crash barrier was estimated to be 1.76 m. After the acoustical design, structural design activity was under taken. Besides the dead load, noise barrier panels are subjected to significant amount of wind load. All structural requirements for the

noise barrier were worked out. Last phase of design involves aesthetic design of barrier. Using CAD techniques it was possible to develop alternate design with different colors and shades of barrier. On the basis of comparison a final design has been adopted. This design has been adopted by PWD for the construction of noise barrier at Britannia Chowk Flyover. After the erection of the barrier, studies were conducted for the effectiveness of the noise barrier considered in terms of the reduction of noise. The barrier erected at the site has been very useful for reducing traffic noise. Interaction with the people living close to the flyover after the erection of the noise barrier shows that there is lot of appreciation for the noise barrier. It was found that due to the noise barrier, apart from reduction in noise, there is also a reduction in dust and the occupants in the vicinity of the flyover had a feeling of safety. In general, the public felt that the erection of the noise barrier is a welcome change for a better environment.

The sixth Chapter deals with the various recommendations for the control of traffic noise. Traffic management systems need to be upgraded in Delhi and network of synchronized road signals requires to be expanded. A number of traffic management measures such as ban on the plying of heavy motorized vehicles on urban arterials passing thorough residential and silence zones, will help to keep the noise level below the permissible values in the above types of land use. The share of non-motorized transport in the overall framework of transport system is quite negligible and accorded a low priority in comparison to motorized modes of transport. There is need for a drastic change in the mindset of transport planners to handle non-motorized modes in a more sensitive manner. The non-motorized transport be implemented to ply on residential streets as well as for smaller trip lengths. Smaller and medium towns with smaller

trip length can develop walk able environment and pursue policies to strengthen pedestrian and bicycle facilities. It is hoped that the study results would be useful to many cities of the country as well as for the development of Transport Infrastructure along the highways and roads in the country.