CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Noise is defined as unwanted or excessive sound, which is an undesirable by-product of our modern way of life. It can be annoying, can interfere with sleep, work, or recreation and in extremes it may cause physical and psychological damage. While noise emanates from many different sources, transportation noise is perhaps the most pervasive and difficult source to avoid in society today.

Urbanisation is increasing at a very fast rate in our country; road length and its conditions are also improving. Therefore, the number of vehicles is increasing at alarming rate of more than 9.9% per annum between 2001 and 2011 [website (1)]. During the period of past 60 years from 1951 to 2011, the number of vehicles has increased from 3 lakhs to 1420 lakhs in India. This has led to traffic congestion on roads and noise pollution. The transportation sector is one of the major contributors to noise in an urban area, accounting for as much as 55% of the total noise in arterials, Bhattacharya C.C. (2002). Road traffic noise is most irritating pollution which has a major concern on communities living in the vicinity of highway corridor. A number of studies have shown that some of the most pervasive source of noise in our environment today is those associated with transportation. Traffic noise tends to be a dominant noise source in our urban as well as rural environment.

In older days, vehicular growth was the blessing, but now days it is destroying the environment. Its effect can be seen not only in India but also all over the world. Various countries have evolved norms for traffic noise; in India, very few efforts have
been made in this field. A body of literatures are already available for prediction of noise models. Many researchers have made significant contributions in this field. The present study is more concerned with the address of the annoyance problems and impact of traffic noise on human health. Effects of traffic noise on human behaviour with respect to noise annoyance as well as its acceptability on a particular residential area have not been addressed by most of the researchers in India. Therefore, an endeavour has been made to determine the annoyance and acceptability level of traffic noise.

In this research study, an emphasis has been given to residential areas, as they are the mostly exposed to traffic noise. The primary concern of the present study is to assess impact of traffic noise on residential community in Delhi Urban Area. The study on the impact analysis of traffic noise on residential area is primarily directed towards evaluation of noise levels in different types of residential areas that would form the basis for understanding the relationship between noise and other associated variables.

1.2 HYPOTHESIS

1.2.1 Null Hypothesis (H₀)

People living along the arterial roads and collector roads are not affected by traffic noise.

1.2.2 Alternate Hypothesis (H₁)

People living along the arterial roads and collector roads are severely affected by traffic noise.

1.3 OBJECTIVES

i. To revisit the state of art on road traffic noise.
ii. To study the noise characteristics under varying traffic conditions at residential areas, primarily influenced by various categories of roads viz. Arterial and Collector Roads.

iii. To assess the impact of traffic noise on residents living along the arterial and collector roads by studying their annoyance levels.

iv. To develop a model for assessment of traffic noise acceptability of the residents living along the Arterial and Collector Roads.

1.4 SCOPE AND LIMITATIONS OF THE STUDY

The scope of the study is limited to residential areas with respect to adjoining Arterial Road and Collector Road in Delhi Urban Area.

1.5 SIGNIFICANCE

Presently, the capital city of Delhi is witnessing rapid growth of vehicular traffic where everyday 1400 motorised vehicles [website (2)] are added on to the roads. The total motorised vehicles of Delhi is more than 7.2 million, which is more than the combined total motorised vehicles registered in other three metropolitan cities namely Mumbai, Chennai and Kolkata. This is one of the major concerns of increasing traffic congestions coupled with the deterioration in the environment with respect to noise and air pollution. This has significantly resulted in deterioration in the standard of living.

Most of the people are affected due to health complications arising due to increased traffic noise in the form of sleeping disorder, blood pressure, shifting of hearing threshold, permanent hearing loss, etc. It also leads to psychological breakdown. It is important to standardize the traffic noise to a level that does not affect the human being. A little or no effort has been made to evolve noise standards with respect to various categories of roads. This research study focuses on determining the acceptability of noise level of people living adjoining the Arterial and Collector Roads in Delhi.
1.6 METHODOLOGY

The methodology for the research study has been worked out keeping in view of the nature and magnitude of work relating to assessment of impact of noise in residential areas. Presently, due to the absence of any specific noise standards along various categories of roads in urban areas, the need to address this issue was felt necessitating this research work to be undertaken. Therefore, an attempt is made to demonstrate the sequence of work to be carried out as a part of this research study and presented in the form of study methodology as shown in the Figure 1.1. In order to carry out the study in most scientific and realistic manner, a number of stages of works addressed are presented as a part of study methodology. There are five stages of work to be carried out as under.

Stage I of the research study deals with the review of literature and studies in the field of traffic noise. At this stage, the review of the past studies on annoyance due to traffic noise, assessment of impact of traffic noise, traffic noise measurement, abatement measures, etc. in residential areas has been undertaken so as to appreciate the nature and magnitude of traffic noise problems in the residential areas as well as techniques on noise measurement and estimates associated with noise studies.

Stage II of the study concerned with appreciation of different types of residential areas that would help in identifying various typologies for selection of case studies of residential areas/category of roads to be undertaken.

Stage III of the study primarily deals with the measurement of traffic noise using noise meter. Perception of residents with respect to their annoyance levels and impact of traffic noise on them has also been studied in depth. The traffic noise data obtained through noise meter has also been related with the traffic data collected as a part of primary survey.

Stage IV of the study is primarily data analysis process where data collected related to traffic noise has been synthesised and analysed with respect to the variation of traffic noise throughout the day, the variation of traffic flow and its composition, etc. Data on
users’ perception would also be extremely useful relating to the effect of traffic noise on users’ health, their irritation and psychological tolerance. These data collected from the various sources have been used as input to develop the traffic noise annoyance model for various types of residents living along the arterial and collector roads.

The final stage i.e. fifth stage of the study, attempt has been made to develop the acceptability of traffic noise among various types of residents living adjacent to arterial and collector roads.
METHODOLOGY

Stage I: Planning/Literature Study
- To review the state of art on traffic noise
- Impact assessment of traffic noise on the residential areas influenced by various categories of roads in urban areas
- Earlier Studies on traffic noise in residential areas
- Planning for conduct of studies

Stage II: Selection of Case Study
- Appreciation of different types of residential areas along various categories of roads in Delhi Urban Area
- Selection of case study areas in residential areas
- Appreciation of parameters responsible for generation of traffic noise in residential areas
- Criteria for selection of residential areas as case studies

Stage III: Conduct of Study
- Traffic noise generating variables
  - Traffic flow
  - Traffic composition
  - Distance
- Conduct of traffic and noise study
- Measurement of Noise
  - Using noise meter
  - Traffic surveys
    - Traffic volume
  - Residents’ Perception Survey
  - User’s perception on traffic noise
  - Impact Assessment of Traffic Noise on Residential Area

Stage IV: Preliminary Data Analysis
- Data Synthesis and Analysis
  - Traffic volume & composition
  - Noise levels ($L_{eq}$)
- Relationship between traffic noise generation and related variables at residential areas

Stage V: Development of noise Acceptability
- Evolving traffic noise acceptability in residential areas
- Conclusions and Recommendations

Figure 1.1: Methodology for the Study
1.7 STRUCTURE OF THE REPORT

Structure of the report is presented below:

Chapter 2 presents the overview of literatures concerned with the present research work like studies related to the annoyance due to traffic noise, assessment of impact of traffic noise, abatement measures, traffic noise and valuation of property, urban forms and noise measurements. The noise standards suggested by World Health Organisation (WHO), the Government of India and by the Governments of various countries of the world are also discussed. The basic definitions of noise are also discussed in this chapter.

Chapter 3 describes about the appreciation of case study area i.e. Delhi Urban Area. The geographical settings, population, transport scenario and pollution levels in Delhi are discussed in the chapter.

Chapter 4 is primarily oriented towards the conduct of primary surveys. The selection criteria for study area, selection of the study area, methodology of conducting primary surveys, types of primary surveys conducted like classified traffic volume survey, noise survey and residents’ perception survey on traffic noise are discussed. The sampling technique adopted to conduct residents’ perception survey is also discussed in this chapter.

Chapter 5 presents about the data analysis and interpretation of data. The data collected through primary surveys like classified traffic volume survey, noise measurement survey and residents’ perception survey on traffic noise at each study area location have been presented and discussed in the chapter.

Chapter 6 demonstrates about the development of traffic noise-annoyance models at each study area location. Methodology for development of noise-annoyance models is presented. Statistical tests and determination of noise annoyance index are demonstrated. The validation of developed noise annoyance models with respect to norms prescribed by the Ministry of Environment and Forest (MoEF), the
Government of India and World Health Organisation (WHO) are presented. Thereafter, the determination of noise level acceptability of residents living along arterial and collector roads are discussed. Noise-annoyance models are also developed with respect to various age groups and their acceptability limits are presented. Noise annoyance models developed with respect to traffic volume for each category of road are also discussed and presented in the chapter.

Chapter 7 is primarily aimed as assessing the impact of traffic noise on residential areas. The adverse effect of noise on human health in general and study area in particular are discussed in this chapter.

Chapter 8 presents the conclusions and recommendations of the study. Future directions for further research required to be carried out are also discussed in this chapter.
