

# Noise Pollution Mitigation for Smart Cities

Gediya Riddhi<sup>1</sup> Patel Rutu J<sup>2</sup> Manisha Tiwari<sup>3</sup>

<sup>1,2,3</sup>CEPT University, Ahmedabad

**Abstract**— The present generation and the coming generations have to solve three grave problems, namely, population, poverty and pollution if they want to survive. In this paper we have selected BRTS route and identified the sound levels at various stops and also stretches between the stops, the sound has been compared with the permissible sound level and it is being assessed. Recommendations regarding mitigation of noise pollution is concluded in conclusions.

**Key words:** Noise Pollution, Smart City

## I. INTRODUCTION

The first question is that what is meant by a 'smart city'. The answer is, there is no universally accepted definition of a smart city. It means different things to different people. The conceptualization of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. In the approach of the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment with an application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a light house to other aspiring cities.

The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart redevelopment), including slums, into better planned ones, thereby improving livability of the whole City.

New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially for the poor and the disadvantaged, leading to inclusive Cities. A city with lesser noise pollution is being considered as a step forward towards transforming into smart city.

Some key definitions are described below:

- Noise- a sound; a harsh disagreeable sound, or such sound.
- Pollution- an excessive or annoying degree of noise in a particular area.
- A decibel is a standard for the measurement of noise. 20db is considered whisper, 40db noise is in quite office, 60 db. Is the noise produced during conversation and 80 db is really painful to ears.

## II. STUDY METHODOLOGY

- 1) Route map is prepared.
- 2) Data on sound levels is collected at bus stops (BRTS ROUTE NO. 12)
- 3) 3. The following observations were taken during the day time (4p.m. to 9 p.m.) on Sunday
- 4) The data is plotted on the maps
- 5) Critical noise levels are marked and their locations are noted.
- 6) Ways to mitigate the high noise pollution are identified.

## III. OBSERVATIONS

A. Current Noise Pollution Level(dBA) In Different Zones of Ahmedabad City:

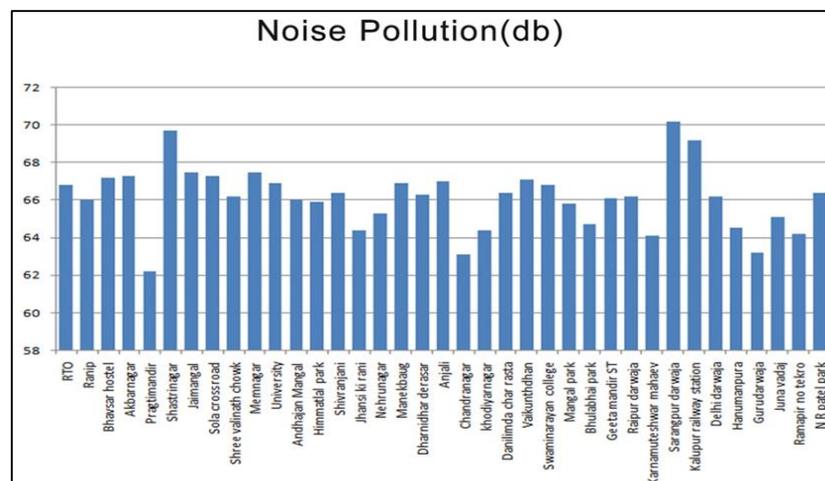


Fig. 1: Noise Pollution



As per Ministry of Environment and Forest, Government of India (1989), the permissible noise levels are given below:

**VI. PERMISSIBLE AMBIENT NOISE LEVEL IN INDIA**

Zone	Noise Limits , DbA	
	DAY TIME	NIGHT TIME
A-Industrial	75	65
B-Commercial	65	55
C-Residential	55	45
D-Silence zone	50	40

Table 2: Noise Levels

- Day Time - 6 a.m. to 9p.m.
- Night Time - 9 p.m. to 6 a.m.
- Silent Zone - Up to 100m around hospital, educational institutions and use of vehicle horns, loud speakers and bursting of crackers shall be banned in this zone.

**VII. NOISE POLLUTION AND SOURCES**

The sources of noise pollution can be classified into three categories such as:

- Traffic sources
- Industrial sources
- Constructional sources

Out of these sources, the traffic source is the major issue.

Noise created by various means of transport like trucks, tractors, buses, trains and aero plane are the major traffic sources:

They may contribute to noise pollution in the form of:

- Horn of vehicles
- Raise of accelerator
- Vehicles with damaged silencer
- Noise produced by diesel car will be more than those which are produced by petrol cars.
- A jet aircraft will produce more noise than a propeller type of aircraft.

**VIII. EFFECTS OF NOISE**

The major effects of noise pollution are:

- Physical effects
- Physiological effects
- Psychological effects

Prominently and progressively more exposure to traffic is a feature of urban environment. An increasing number of vehicles, difficulty of control of emitted noise and high numbers of exposed persons to noise intensify undesirable transportation noise effects. It was approved that noisy environment can disturb brain activity, processing of mental tasks, and also may cause tribulation in conversation. Common noise related problems are interference with communication and sleep disturbance.

Decreased quality in sleep is considered to be a major health outcome of environmental noise. Noise exposure can also cause other non-auditory effects such as annoyance, changes in behavior and deterioration in performance. Because some stressful effects depend on qualities of the sound other than its absolute decibel value, the annoyance associated with sound may need to be considered in regard to health effect. When young children are continuously exposed to noise that interfere with speech, they may develop speech or reading difficulties, because auditory processing functions are compromised.

High noise levels can contribute to cardiovascular effects and exposure to moderately high levels during a single eight-hour period causes a statistical rise in blood pressure of five to ten points and increase in stress. Noise can have a detrimental effect on wild animals, increasing the risk of death by changing the delicate balance in predator or prey detection and avoidance, and interfering the use of the sounds in communication. The building materials may get damaged by exposure to infrasonic/ultrasonic waves and even get collapsed.

**IX. WAYS TO MITIGATE NOISE SOUND POLLUTION**

Noise control or noise mitigation is a set of strategies to reduce noise pollution or to reduce the impact of that noise, whether outdoor or indoor.

The most fertile areas for roadway noise mitigation are in urban planning decisions, roadway design, speed control, surface pavement selection and truck restrictions.

#### A. Wall Construction to Absorb Noise

Noise barriers, they are the solid obstruction built between the way and homes along the road. They do not completely block all noise they only reduce overall noise. They effectively reduces noise levels by 5 to 10 decibels, cutting the loudness of traffic noise by as much as one half. They reduces the sound by either absorbing the sound, transmitting it, reflecting it back across the highway, or forcing it to take a longer path over and around the barrier. To effectively reduce sound transmission through the barrier, the material chosen must be rigid and sufficiently dense (at least 20 kilograms/ cubic meter). All noise barrier material types are equally effective and acoustic, if they have this density.

It can be constructed from earth, concrete, masonry, wood, metal and many other materials. Noise barrier walls made of absorptive material mitigate sound differently than those that are hard surface. A noise reducing barrier wall with a porous surface material and sound dampening content material is said to be absorptive. This means little or no sound is reflected back towards the source or elsewhere. Hard surfaces such as masonry or concrete are considered to be reflective. This means most of the noise source and beyond.

Vegetation, if it is high enough, wide enough, and dense enough that it cannot be seen over or through, can decrease highway traffic noise. A wide strip of trees with very thick undergrowth can lower the noise. Round about 30 meters of dense vegetation can reduces noise by 5 decibels.

#### B. Porous Pavements

Porous pavements or Noise reducing pavements can be used in conjunction with other measures, but noise reducing pavements should always be the first choice measure because it attacks the problematic source (tire-road-noise) and it is often the most cost-effective measure of noise abatement. The traffic noise level at a certain pavement increases due to wear and tear so it is also necessary to define the age of a reference pavement. With this in mind ,it can be difficult to compare noise reductions presented in different countries as the 'zero level' may vary significantly.

Porous pavements materials consist – in a broad description –of an aggregate skeleton with a void structure covered or partly filled with a rich bituminous mortar which often is modified or stabilized by addition of polymers, waxes and cellulose fibers.

#### C. Source Control

Source control in roadway noise has provided little reduction in vehicle noise, except for the development of the hybrid vehicles. Nevertheless, hybrid use will need to attain a market share of roughly fifty percent to have a major impact on noise source reduction of city streets.

#### D. Rules and Regulations

Every motor vehicle manufactured shall be fitted with an electric horn or other devices (Confirming to the requirements of IS-1884-1992 specified by the bureau of Indian standards) for use of driver of the vehicle and capable of giving audible and sufficient warning of the approach or position of vehicles.

##### 1) Rule 119(1), the Central Motor Vehicles Rules, 1989

Note: Not having a functional horn would be violative of above mentioned rule and would thus be an offence.

No motor vehicle shall be fitted with any multi-toned horn giving a succession of different notes or with any other sound producing device giving an unduly harsh, shrill, loud or alarming noise.

Vehicles used as ambulance, fire fighting purpose, salvage purpose, vehicles used by police officers or officers of the motor vehicles department in the course of their duties or on construction equipment vehicles, may use such sound signals as may be approved by the registering authority in whose vehicles are kept.

##### 2) Rule 119(2)(3), The Central Motor Vehicles Rules, 1989

A drivers of a vehicle shall not

- Sound the horn needlessly or continuously or more than necessary to ensure safety;
- Sound the horn in silence zone;
- Fit or use any multi toned horn giving harsh ,shrill ,loud or alarming noise

Regulation 21(1)(2)(4) the Rules of the Roads Regulation, 1989

No driver of a motor vehicle shall sound the horn or other device for giving audible warning with which the motor vehicle is equipped shall cause or allow any other person to do so.

Rule 170(1), Haryana Motor vehicles Rules, 1993

Rule 178(1), Chandigarh Motor vehicles rules,1990

No vehicles shall be permitted to have musical horn. All vehicles, buses, trucks and cars shall not be fitted with power, pressure or musical horns. Such vehicles with any such horns shall be chicaned and such horns shall be got removed by the enforcement officer so authorized to chicane the vehicle, under his supervision.

#### E. Speed Control

Speed control is also an effective way to check noise pollution, since the lowest sound emission arise from vehicles moving smoothly at 30 to 60 kilometers per hour. Above that range, sound emissions will almost double with each five miles per hour of speed. At the lowest speeds, braking and acceleration noise dominates.

## **X. CONCLUSION OF STUDY**

This study concludes that a very few bus stops of Ahmedabad (Pragtimandir, Chandranagar and Gurudarwaja) have their noise levels less than 65 db. Thus some areas have a high effect of noise pollution in day time. Shastrinagar, Kalupur Railway station and SarangpurDarwaja are a part of such high effect.

It is recommended that the measures, such as restriction on the use of loud speakers/public address system or sound producing instruments, restriction in the use of horns and sound emitting construction equipments should be avoided. Planting of trees along the roadside, near the hospitals, schools etc helps in reduction of noise pollution. For effective Noise Mitigation, new barriers, porous pavements etc. should be made.

Noise pollution is a very serious issue worldwide and certain measures to control it might help in solving many problems caused by high noise pollution.