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ROAD TARFFIC NOISE ASSESMENT IN INDIA – A REVIEW

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Abstract

In the recent years Transportation projects in India have created excessive Noise pollution which is displeasing the activity or balance of human and animal life. Noise health effects are both health and behavioural in nature. Noise can damage physiological and psychological health of Human being. Noise pollution can cause annoyance and aggression, hypertension, high stress levels, hearing loss, sleep disturbances. In the present study, attempts are made to evaluate the different parameters related to road traffic noise in India. The broad objective of this paper is to present the brief literature about the Road traffic noise in Indian context. Various topics such as Literature review, harmful effects of noise pollution, classification of noise, sources of noise pollution, noise standards, noise indicators are covered in this paper.

Index Terms: *Noise Pollution India, Road traffic noise*

1. INTRODUCTION

The environmental effects of transportation projects have come under close scrutiny in recent years. Noise is an inevitable part of everyday life, Mild noise can be annoying, excessive noise can destroy a person's hearing. The slightest unwanted sound can become very annoying if it continues for any length of time. While some nearby residents may ignore the continuous hum of a busy freeway, others will never be able to ignore it and increasingly will find it irritating. Over the years the general incidence of noise has been increasing, the development of the steam engine, the petrol engine, and technological machinery in industry, contributed to an increasingly noisy environment in the nineteenth century. This has been further exacerbated in the twentieth century by the diesel engines, the turbo prop and jet engine, the increasing use of faster industrial production machinery, construction site machinery and the increased volume of road traffic. Disturbance by noise is probably the most important environmental impact of the transportation apparatus and affects a large number of people, particularly those living in built-up areas.

2. LITRATURE REVIEW

Road traffic is a major source of noise in urban areas (Skanberg and Ohrstrom, 2002), with far-reaching and wide range effect to humans (Pandya,2003). Nelson (1987) reported that long term exposure to occupational noise can result in permanent hearing loss. Moreover, commonly experienced noise effects may include annoyance, deterioration in sleep quality, and stress related ischemic heart disease (NHC, 1997; Morrell et al., 1997). Generally, motor vehicles, which form a significant part of urban environment, are an important source of noise emission, contributing about 55% of the total urban noise (Banerjee et al., 2008; Nirjar et al., 2003).

In developing countries, road traffic noise is not yet recognized as a major problem but since 1990s, there has been a phenomenal increase vehicle ownership due to better economic status of the people leading to growing awareness of traffic noise pollution. This has lead to more public funding on its assessment and evaluation.

In the Indian context, Prabat and Nagarnaik (2007) mentions that the Indian cities face transport crisis characterized by ill-planning, congestion, noise pollution, improper traffic facilities, injuries and inequality as compared to contemporary cities in most of Europe and North America. Bhattacharya et al. (2001) also subscribes to the similar opinion stating that Indian cities have heterogeneous vehicular traffic flow on the same right-of-way with interrupted traffic flow conditions. Singh and Jain (1995) conducted study of noise level at 19 sites comprising of residential, industrial and commercial areas of Delhi and found that commercial areas have the highest noise levels followed by industrial and residential areas. Sampath et al. (2004) obtained ambient noise levels in major cities in Kerala due to traffic operation. The commercial areas and silence zones of Thiruvananthapuram, Kochi and Kozhikode cities had noise level higher than the prescribed limits. Sound levels inside residential buildings at night during festival time exceed the limits by 30 to 40 dB. They also found that the announcements made from vehicles fitted with PA

system can cause sound levels above 100 dB(A) at a distance of 10 to 15 metres.

Vidya Sagar and Nageswara Rao (2006) evaluated noise pollution levels in Vishakhapatnam city. They found that a hospital in silence zone exceeded the Ambient Air Quality Noise Standards (AAQNS) by more than 10 dB(A) both in day time and night time. In commercial zone, the noise levels were in the range of 80±10 dB(A).

In their work on evaluation and analysis of road traffic noise in Asansol city, Banerjee et al. (2008) reported that in all 35 study locations, the noise level exceeded the limits prescribed by the Central Pollution Control Board (CPCB). The day-night L50 ranged between 55.1- 87.3 dB(A); while day-time and night-time Leq ranged between 51.2-89 and 43.5-81.9 dB(A) respectively. Hunashal and Patil (2012) made an assessment of noise pollution indices of Kolhapur city and stated that highest Leq of 72.25 dB(A) was observed on industrial cum-residential zone followed by 64.47 dB(A) in commercial-cum-residential zone, 63.71 dB(A) in educational zone, 53.26 dB(A) in recreational zone and 42.84 dB(A) in silence zone. He devised interfacial zones as against conventional land-uses stipulated by CPCB.

Chauhan et al. (2010) made assessment of noise level of Haridwar city. They found that traffic noise was the significant contributor to the overall noise. The variation range of SPLmin and SPLmax was between 56.6- 102.4 dB in residential zone; 56.7-108.9 dB in commercial zone; 52.4-65.8 dB in industrial zone; and 45-87.8 dB in silence zone. He suggested widening of narrow roads, diversion of traffic to reduce traffic volume, plantation of evergreen trees, restriction on entry of heavy buses and trucks, penalization on use of pressure horns, segregation of slow moving traffic by constructing dedicated lane among other measures. Chauhan et al. (2010) had also reported that the level of noise pollution in residential, commercial, industrial and silence zones of Moradabad city were higher than the limits of CPCB. Gangwar et al. (2006) has reported that the noise level in Bareilly metropolitan city was slightly higher than the prescribed limits of CPCB. Kisku et al. (2006) had reported that in residential areas, noise ranged between 67.7-78.9 and 52.9-56.4; in commercial area between 74.8-84.2 and 68.2-74.9; and in industrial areas between 76.9-77.2 and 72.2-73.1 during day and night time respectively at Lucknow city. Noise levels at all selected sites were found to be higher than that prescribed by the CPCB.

Pathak et al. (2008) made evaluation of traffic noise pollution and attitudes of exposed individuals in working place of Varanasi city and found that the noise levels have reached an alarming level. 85% of the people were disturbed by traffic noise, about 90% reported that traffic noise is the main cause of headache, high BP, dizziness and fatigue. People with higher education and income level were much aware of health impact due to traffic noise. Traffic noise was found to be interfering with daily activities like resting, reading, communication etc. Pathak et al. (2008) had mentioned in their study that rapid urbanization, industrialization, expansion of road network and infrastructure has caused severe noise pollution problem in Varanasi.

3. HARMFUL EFFECTS OF NOISE

Noise is considered a serious threat to the environmental health. Some of the adverse effects of noise pollution are given below:

1. It interferes with speech. In the presence of noise we may not able to follow, what the other person is saying.
2. Noise leads to emotional and behavioral stress. A person may feel disturbed in the presence of loud noise such as produced by heating of drums.
3. Noise may permanently damage hearing. A sudden loud noise can cause severe damage to the eardrum.
4. Noise increases the chances of occurrence of diseases such as headache, blood pressure, heart failure, etc.
5. Noise leads to increased heart beat, constriction of blood vessels and dilation of pupil.
6. Noise is a problem especially for patients who need rest.
7. Noise may cause damage to liver, brain and heart.
8. It creates annoyance to the receptors due to sound level fluctuations. The aperiodic sound due to its irregular occurrences causes displeasure to hearing and causes annoyance.
9. The physiological features like breathing amplitude, blood pressure, heart-beat rate, pulse rate, blood cholesterol are affected.
10. The working performance of workers/human will be affected as they will be losing their concentration.
11. It causes pain, ringing in the ears, feeling of tiredness, thereby effecting the functioning of human system.
12. It affects the sleeping there by inducing the people to become restless and lose concentration and presence of mind during their activities
13. The buildings and materials may get damaged by exposure to infrasonic / ultrasonic waves and even get collapsed.

4. CLASSIFICATION OF NOISE

4.1 Environmental Noise

Environmental noise is the collection of offending sounds to which humans are involuntarily exposed. The principal sources of environmental noise are motor vehicles, aircraft and, increasingly, entertainment from live or reproduced music. Environmental noise is commonly referred to as Noise pollution. Environmental noise is governed by noise regulations which set maximum recommended levels of sound levels for specific land uses, such as residential areas, schools, areas of outstanding natural beauty, or factories. These standards often specify measurement using a weighting filter, most often A-weighting, but in many cases this is not

appropriate as it gives a reduced response to low frequency sounds, and does not take account of the increased annoyance value of bass boom from modern pop music, which penetrates walls and windows more easily than higher frequencies. Standards for the measurement of entertainment noise are currently confused and several research projects have recently set out to determine a valid method. There are significant noise health effects, both physiological and psychological. Environmental noise is usually measured in decibels, because of the great dynamic range of the human ear.

4.2 Acoustic Noise

When speaking of noise in relation to sound, what is commonly meant is meaningless sound of greater than usual volume. Thus, a loud activity may be referred to as noisy. However, conversations of other people may be called noise for people not involved in any of them, and noise can be any unwanted sound such as the noise of aircraft, neighbours playing loud music, or road noise spoiling the quiet of the countryside.

4.3 Industrial Noise

Industrial noise is usually considered mainly from the point of view of environmental health, rather than nuisance, as sustained exposure causes permanent hearing damage. A-weighted measurements are commonly use for this well, and special exposure meters are available that integrate noise over a period of time to give an Leq value (equivalent sound pressure level), defined by standards. In the case of industrial noise affecting nearby residences or other sensitive receptors, the phenomenon is considered noise pollution.

4.4 Audio noise

In audio, recording and broadcast systems audio noise refers to the residual low level sound (usually hiss and hum) that is heard in quiet periods of program me. In audio engineering it can also refer to the unwanted residual electronic noise signal that gives rise to acoustic noise heard as 'hiss'.

4.5 Radio noise

Radio noise is interference picked up between transmitter and receiver output, often referred to as static. Radio noise can be caused by virtually any electromagnetic source, from lightning to man-made electronics, including the receiver itself. Transmitter power must be increased to overcome radio noise over long distances.

4.6 Video noise

In video and television, noise refers to the random dot pattern that is superimposed on the picture as a result of electronic noise, the 'snow' that is seen with poor (analog) television reception or on VHS tapes. Interference and static are other forms of noise, in the sense that they are unwanted, though not random, which can affect radio and television signals.

4.7 Electronic noise

Electronic noise exists in all circuits and devices as a result of thermal noise, also referred to as Johnson Noise. Semiconductor devices can also contribute flicker noise and generation-recombination noise. In any electronic circuit, there exist random variations in current or voltage caused by the random movement of the electrons carrying the current as they are jolted around by thermal energy. The lower the temperature the lower is this thermal noise. This same phenomenon limits the minimum signal level that any radio receiver can usefully respond to, because there will always be a small but significant amount of thermal noise arising in its input circuits. This is why radio telescopes, which search for very low levels of signal from stars, use front-end low-noise amplifier circuits, usually mounted on the aerial dish, cooled in liquid nitrogen to a very low temperature.

5. SOURCES OF NOISE POLLUTION

Broadly speaking, the noise pollution has two sources, i.e. industrial and non- industrial. The industrial source includes the noise from various industries and big machines working at a very high speed and high noise intensity. Non- industrial source of noise includes the noise created by transport/vehicular traffic and the neighbourhood noise generated by various noise pollution can also be divided in the categories, namely, natural and manmade. Most leading noise sources will fall into the following categories: roads traffic, aircraft, railroads, construction, industry, noise in buildings, and consumer products.

5.1 Road Traffic Noise

In the city, the main sources of traffic noise are the motors and exhaust system of autos, smaller trucks, buses, and motorcycles. This type of noise can be augmented by narrow streets and tall buildings, which produce a canyon in which traffic noise reverberates.

5.2 Air Craft Noise

Now-a-days , the problem of low flying military aircraft has added a new dimension to community annoyance, as the nation seeks to improve its nap-of the- earth aircraft operations over national parks, wilderness areas , and other areas previously unaffected by aircraft noise has claimed national attention over recent years.

5.3 Noise from railways

The noise from locomotive engines, horns and whistles, and switching and shunting operation in rail yards can impact neighbouring communities and railroad workers. For example, rail car retarders can produce a high frequency, high level screech that can reach peak levels of 120 dB at a distance of 30m, which translates to levels as high as 138, or 140 dB at the railroad worker's ear.

5.4 Construction Noise

The noise from the construction of highways, city streets, and buildings is a major contributor to the urban scene. Construction noise sources include pneumatic hammers, air compressors, bulldozers, loaders, dump trucks (and their back-up signals), and pavement breakers.

5.5 Noise in Industry

Although industrial noise is one of the less prevalent community noise problems, neighbours of noisy manufacturing plants can be disturbed by sources such as fans, motors, and compressors mounted on the outside of buildings Interior noise can also be transmitted to the community through open windows and doors, and even through building walls. These interior noise sources have significant impacts on industrial workers, among whom noise- induced hearing loss is unfortunately common.

5.6 Noise in building

Apartment dwellers are often annoyed by noise in their homes, especially when the building is not well designed and constructed. In this case, internal building noise from plumbing, boilers, generators, air conditioners, and fans, can be audible and annoying. Improperly insulated walls and ceilings can reveal the sound of-amplified music, voices, footfalls and noisy activities from neighbouring units. External noise from emergency vehicles, traffic, refuse collection, and other city noises can be a problem for urban residents, especially when windows are open or insufficiently glazed.

5.7 Noise from Consumer products

Certain household equipment, such as vacuum cleaners and some kitchen appliances have been and continue to be noisemakers, although their contribution to the daily noise dose is usually not very large.

Table-1: Noise levels of noisy sources

Sources	Noise Level dB(A)
Threshold of audibility	0
Breathing	10
Quiet conversation	20-30
Ticking clock	30
House in quiet street	35
Inside small shops	55
Computer rooms	55-60
Loud conversation	60
Office noise	65
Class room teaching	55-60
Home appliances	65-75
Household generators	70-80
Medium road traffic	70-80
Heavy road traffic	80-90
Sports car	80-95
Inside cinema theatre	85-95
Buses and trucks	85-95
Freight trains at 7.5m	96
Trucks	90-100
Laboratory machines	90-100
Concrete mixture	90-105
Motor cycle and cars	90-105
Rail engines at 15 m	97-105
Train whistle at 15 m	110
Loud speakers	100-120
Threshold of pain	120
Diwali crackers	125-160
Exploding bomb	190

6. AMBIENT AIR QUALITY NOISE STANDARDS (AAQNS)

Most of the countries, keeping in view the alarming increase in environmental noise pollution, have given the permissible noise standards. These are depending on the location and period of day. Industrial areas obviously have somewhat higher acceptable sound levels than those prescribed for residential areas. The collected night standards are stringent than the daytime standards.

6.1 Standards by Law in India

Noise has been recognized as ambient air pollutant. Standards in this regard are laid down under Environment (Protection) Rules, 1986 and under the Model Rules of the Factories Act, 1948.The Central Pollution Control Board constituted a Committee on Noise Pollution Control. The Committee recommended noise standards for ambient air and for automobiles, domestic appliances and construction equipment, which were later notified in Environment (Protection) Rules, 1986 as given below in Table-2.

Table 2-Noise Standards for Different Category of Area

Area Code	Category of Area	Limits in dB(A), Leq	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence Zone	50	40

Note:

1) Day time is reckoned in between 6 a.m. and 9 p.m.
2) Night time is reckoned in between 9 p.m. and 6 a.m.
3) Silence zone is referred as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority.
4) Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.
5) Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.

6.2 Recommended noise levels by the Bureau of Indian Standards (BIS)

Bureau of Indian Standards has recommended acceptable noise levels in residential areas, injury range and safe range are as given in Table-3, 4 and 5, respectively.

Table-3 Acceptable noise levels in Residential Areas

Sr. No.	Location	Acceptable Noise Level in Residential Areas, dB(A)
1	Rural	25-35
2	Suburban	30-40
3	Residential (urban)	35-45
4	Urban (Residential	40-45

	and Business)	
5	City	45-50
6	Industrial Areas	50-60

Table-4 Acceptable noise levels in Injury Range

Sound	Decibels (dB)
Race car, loud thunder, rock band	120-130
Jack hammer	130
Jet airplane's takeoff from 120 feet	120
Pain threshold	130
Rocket launch from 150 feet	180

Table-5 Acceptable noise levels in Safe Range

Sound	Decibels (dB)
Stream flow, rustling leaves	15
Watch ticking, soft whisper	20-30
Quiet street noises	40
Normal conversation	45-60
Normal city or freeway traffic	70
Hair dryer	80
Motorcycle, electric shaver	85
Lawn mower, heavy equipment	90
Garbage truck	100
Screaming baby	115

6.3 Ambient noise level standards as prescribed by World Health Organization (WHO)

Recommended noise exposure limits are shown in Table-6.

Table-6 Recommended Noise Exposure Limits (WHO-1990)

1	Indoor/domestic night time	35 dB(A)	Increased awakening at higher levels
2	Indoor/domestic day time	45 dB(A)	Speech communication deteriorates at higher levels
3	Community /Urban night time	45 dB(A)	Difficulties in falling asleep at higher levels
4	Community /Urban day time	55 dB(A)	Annoyance increases at higher levels
5	Industrial occupational	75 dB(A)	Predictable risk of hearing impairment at higher level

(http://mpcb.mah.nic.in, http://www.epa.nsw.gov.au)

7. NOISE INDICATORS

7.1 The equivalent continuous sound level (Leq)

The equivalent continuous sound level has been adopted in a number of countries as means of measuring and assessing noise. It is sometimes referred to by various other terms than equivalent continuous sound level, such as mean energy level and equivalent sound level. The equivalent continuous sound level is given by the level of study noise that has the same energy as the actual time varying noise in question.

$$Leq = L50+[(L10-L90)2/56] \text{ dB(A)}$$

7.2 Noise pollution level (LNP)

Noise pollution level specifically devised to take the account of more complex time varying noises. The scale takes account of the equivalent continuous sound level over a particular period of time together with the variability of the noise environment.LNP is significant because in principle, it accounts for annoyance from aircraft, traffic and other sources such as industrial noise. Maximum permissible outdoor value of LNP is 88dB(A)

$$LNP = Leq + (L10-L90) \text{ dB(A)}$$

7.3 Traffic noise index (TNI)

It correlates with dissatisfaction towards traffic noise expressed by people. The measurement of TNI is difficult because of the uncertainty arising from background noise coming from sources other than traffic on the road being considered. Prediction is also difficult because of problem in predicting the background noise at large distance from the road.TNI value of 74dB(A) was found by likely to give a 50 % community dissatisfaction with the traffic noise.

$$TNI = 4 (L10-L90)+ L90-30 \text{ dB(A)}$$

7.4 Noise Climate (NC)

It is the range over which the sound levels are fluctuating in an interval of time.

$$NC = L10 - L90 \text{ dB(A)}$$

8. CONCLUSION

To evaluate the different parameters related to road traffic noise in India, literature survey was carried out. The broad objective of this paper is to present the brief literature about the Road traffic noise in Indian context. Work regarding the noise pollution has already been done in developed countries, where as a little could be done in developing country like India. Mild noise can be annoying, excessive noise can destroy a person's hearing. The slightest unwanted sound can become very annoying if it continues for any length of time.

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