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A Review on Noise Pollution due to Traffic

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Abstract: Noise pollution, in the recent times, has been well recognized as one of the major trepidations that impact the quality of life in urban areas across the globe. India's major cities are rapidly emerging as industrialized and urbanized cities and have started facing severe noise pollution problems. Noise compared to other types of pollution disrupts daily routine and quality of life. Noise level more than permissible limit, is called noise pollution. It is underrated environmental problem. Every day several vehicles are moving in and around the city resulting in immense heavy traffic congestion and severe noise pollution. Therefore most of the major roads experience huge vehicular congestion during peak hours and it crosses the permissible limit of noise. This paper includes a study on hazardous effects of Noise Pollution and reviews the literature on research carried out in various years and different parts of the world to demonstrate the current status of noise pollution due to traffic.

Keywords- Noise pollution, Road Traffic Noise, Environment, Hazardous Effects, Decibel

I. INTRODUCTION

Noise pollution refers to undesirable levels of noises caused by human activity that disrupt the standard of living in the affected area. Noise pollution can come from:

- A. Traffic
- B. Airports
- C. Railroads
- D. Manufacturing plants/ Industry
- E. Construction or demolition activities
- F. Concerts, Congregations, etc.

Some noise pollution may be temporary while other sources are permanent. Effects may include hearing loss, wildlife disturbances, and a general degradation of lifestyle. Noise pollution is excessive uproar that may harm the activity or balance of human or animal life.

Poor urban planning may give rise to noise pollution. Higher levels of noise can even contribute to cardiovascular effects in humans. In animals, noise can increase the risk of death by altering predator or prey detection and avoidance, interfere with reproduction and navigation, and also contributes to permanent hearing loss.

II. CLASSIFICATION OF NOISE POLLUTION

Pollution can be classified into following types depending upon the sources of generation:

A. Community Noise Pollution

Community noise pollution is mainly spreading in the environment due to various activities which can be further sub-divided.

- 1) **Road Traffic Noise:** Traffic noise is increasing due to rapid increase in number of road vehicles. The noise is spreading mainly due to traffic speed as the volume of the noise enhances with the traffic speed
- 2) **Domestic Noise:** This includes all types of noises that are common in residential areas like noise of music players, television, alarms, animals, construction noise, use of kitchen appliances, etc., depending on its intensity and volume.
- 3) **Aircraft Noise:** The phases of a flight including take off, landing etc. have an adverse effect on the people associated with the flight processes but also the people residing near airports. These noise levels are much higher having a peak near 100 -120 dB which is extremely hazardous to the health.

B. Occupational Noise Pollution

The pollution which is present in the environment due to noises on work places, factories, and industries i.e. the noise of machines, tools, and other working equipment at work. Depending on the time of exposure, these noises have been divided into following three types:

- 1) *Continuous Noise*: It is defined as the noise whose highest levels occur more often than once per second. It is produced by the machinery that operates without interruption e.g. pumps, compressors and processing equipments etc.
- 2) *Intermittent Noise*: The noise that is not continuous with time i.e., taking alternating periods of start and stop is called intermittent noise e.g. drill machines.

C. Impulse Noise

It is the noise that gives rise to instantaneous sharp sound for small time duration and then diminishes e.g. blasting. The sound pressure in this type may vary from 40dB (minimum) to 200 dB or even more which is sufficient to destroy internal organs.

D. Ambient Noise Pollution

In atmosphere, ambient noise level, sometimes called background noise level, is the background sound pressure level at a given location, normally specified as a reference level to study a new intrusive sound source.

Ambient noise levels may be measured to provide a reference point for analysing an intrusive sound to a given environment.

III. PARAMETERS OF NOISE POLLUTION MEASUREMENT

A. Loudness

It is subjective perception of sound pressure. It is defined as, that attribute of auditory sensation in terms of which sound can be ordered on a scale extending from quiet to loud.

B. Decibel (dB)

It is used to measure sound level, but it is also widely used in electronics, signals and communication. The dB is a logarithmic way of describing a ratio. The ratio is of power, sound pressure, voltage or intensity or several other things.

C. Sound Pressure Level

It is the ratio of absolute, sound pressure and reference level (usually the Threshold of Hearing, or the lowest intensity sound that can be heard by the people). SPL is measured in decibels (dB). The threshold of hearing is 4 dB.

D. dB(A), dB(B), dB(C)

These are the frequency filters used to be sensed by human ear. With dB(A) filter the sound level meter is less sensitive to very high and very low frequencies. Decibel (C) is suitable to measure at very high sound pressure levels. The dB (B) lies between dB(A) and dB(C).

E. Leq

Equivalent continuous sound level, is the preferred method to describe the sound level that vary over time resulting in a single decibel value which takes into account the total sound energy over the period of time of interest

Noise limits for various zones and category of vehicles have been notified in Part E, Schedule-VI of Environment Protection rules, 1986, as amended on 19 May 1993 by Ministry of Environment & Forests, New Delhi, India, as given in the tables below:

TABLE 1.2: DAY AND NIGHT NOISE LIMITS

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

TABLE1.3:SAFE LIMITS IN VARIOUS CONDITIONS

No.	Category of Vehicle	Noise limit in dB(A)
a.	Motorcycle, scooters and three wheelers.	80
b.	Passenger Cars	82
c.	Passenger or commercial vehicles up to 4 MT	85
d.	Passenger or commercial vehicles above 4 MT and up to 12 MT	89
e.	Passenger or commercial vehicles exceeding 12 MT	91

IV. HAZARDOUS EFFECTS OF THE NOISE POLLUTION

A. Health effects on human Beings

Noise pollution affects the human beings in two ways which are:

- 1) *Auditory effects:* It effects when sound interferes with the functions of hearing mechanism. The first organ that gets affected by the noise is the ear. More than 50% of our working community complains of tinnitus (continuous ringing noise) in the ear. Continuous exposure may lead to deafness or permanent loss of hearing
- 2) *Non-auditory Effects:* Non-auditory effects can be defined as "all the effects on health and welfare due to the noise exposure apart from the effects on the hearing organs." they affect the social behaviour of the objects also altering the normal biological functioning of the body. Annoyance is the most basic level and On the other hand, it can directly affect health. The degree to which it may affect the health depends on the parameters including the intensity, pressure, volume, duration and the nature of the noise.

B. Annoyance

It is the most prevalent response to the noise, including fear and mild anger. Annoyance reactions are associated with the degree of interference that any noise causes in everyday activities, which probably precedes and leads on to annoyance. In both traffic and aircraft noise studies, the noise levels have been found to be associated with annoyance.

C. Noise Pollution and Sleep Interference

Exposure to the noise for a long duration disturbs sleep resulting in raised anxiety levels. Objective sleep disturbance will develop if more than 50 noise events per night with a maximum level of 50 dB are at indoors or more. But, for the outdoor noise levels the value is quite low. Noise exposure during sleep may elevate blood pressure, heart rate, pulse amplitude and affect body movements. Following disturbed sleep, there may also be after-effects during the day; perceived sleep quality, short temper and daily performance levels are decreased due to sleep disturbed by road traffic noise.

D. Effects on Performance

It has been concluded from the laboratory studies, that noise exposure impairs routine performance. Noise exposure also slows down the rehearsal and the selectivity processes in memory, and the choice of strategies for particular tasks. It has also been observed that noise may reduce helping behaviour, increase violence and reduce the obedience of social cues.

E. Physiological Responses

The continuous exposure to noise causes numerous short-term physiological responses as transmitted through the nervous system. Exposure to noise causes physiological activation including elevated heart rate and blood pressure, etc. There is habituation to brief noise exposure but to the prolonged noise, habituation is less certain.

F. Cardiovascular Effects

Studies have suggested that individuals exposed to continuous noise of at least 85 dB have higher blood pressure. There is some evidence from community studies that environmental noise is related to hypertension and also a minor risk factor for coronary heart disease.

G. Psychiatric Effects

Early studies showed that regular exposure to high levels of noise to the factory workers and inhabitants of overpopulated areas complain about nausea, headache, anxiety, restless nights, and edgy tempers.

H. Cognitive Behaviour in Children

children belong to a group which is especially vulnerable and sensitive to environmental pollution and all of its types. Studies have found the effect of environmental noise activities on children. The research shows that noise pollution does not affect all cognitive structures uniformly, affecting mainly central processing and understanding of the language. Difficulties have been found in concentration and visual attention.

I. Effect of Noise Pollution on Wildlife:

Noise pollution can be harmful to the animals. High enough levels of the noise pollution may interfere with the natural cycles of the animals, which may change their migration paths to avoid the sound; moreover, masking which is the inability to perceive sound of ecological cues and animal signals.

Plenty of evidences exist to prove that serious damage is occurring to the wild animals. Long-term effects from medium to low level noise intrusion need much more study, with emphasis on threatened and endangered species.

V. NEED OF STUDY

Now a days noise pollution is becoming one of the major concerns out of various types of pollutions. As India is one of the most developing countries, traffic due to urbanization is increasing on roads heavily. As per previous statistical studies made, it has been concluded that all the major cities in the country has alarming situations of increasing vehicular traffic. This, in return, has increased the noise levels up to that extent, that they have crossed the setup standards of government organisations. Despite being a planned city Chandigarh, known as the city beautiful, it has observed a phenomenal growth in vehicular population. It is also suffering from the same situation where number of increasing vehicles on road and the traffic noise pollution due to that traffic has started causing nuisance not only in work places but also in residential areas leading to various health hazards. Therefore, it is necessary to study the noise level conditions of various roads and check the urgency of taking preventive measures for the control of noise pollution due to traffic.

VI. LITERATURE REVIEW

[1] James (1998) showed that resident's reactions to an audible environmental noise (a target noise) are only slightly or not at all reduced by the presence of another noise source (ambient noise) in residential environments. Although there is considerable variation from survey to survey, the best direct estimate is that approximately a 20-dB increase in ambient noise exposure has no more impact than approximately a 1-dB decrease in target noise exposure. Tabulations of 12 findings from laboratory studies in which subjects rated periods of multiple noise events also found that target noise annoyance is not consistently reduced by ambient noise.

[2] Wats and Godfry (1999) studied that there is considerable interest in the use of sound absorptive materials for reducing noise reflected from noise barriers although there is little reliable information on their effectiveness in practice. The primary object was to determine, under carefully controlled measurement conditions, the effects on roadside noise levels of applying sound absorptive materials to the traffic face of noise barriers. Measurement of traffic noise were made close to the roads both behind and opposite the barriers with the panels in the normal position and then measurements were repeated after the panels had been reversed such that the reflective side faced the traffic. It was found that at both sites there was an increase of noise of generally less than 1 dB when the barrier face was changed from sound absorptive to reflective.

[3] Razdanand Sidhu (2000) studied the ill effects tagged to noise. Noise acts upon the body very much as other stresses do and so its effects are far reaching affecting not just hearing but other body functions too. This article tries to generate some interest and controversies on the subject to initiate more action on noise pollution.

[4] Oberoi et al (2004) conducted the studies to trace the amount of damage caused by the noise from various natural as well as man-made sources, especially traffic. This paper identifies the various legislative provisions available in India and other parts of the world to check this menace. Reference has also been made to the conclusions from the studies by researchers, legislative cases involving noise pollution and the statistical analysis of the current situation. Thus an attempt has been made to give an overview of the complete scenario of noise pollution-related laws and jurisdictions, to make this paper useful for researchers, planners, administrators and people concerned with the enactment and enforcement of law.

[5] Goines and Hagler(2007) concluded that use of increasingly powerful, varied, and highly mobile sources of noise will continue to grow because of sustained growth in highway, rail, and air traffic, which remain major sources of environmental noise. It interferes with sleep, concentration, communication, and recreation. The aim of enlightened governmental controls should be to protect citizens from the adverse effects of airborne pollution, including those produced by noise. People have the right to choose the nature of their acoustical environment; it should not be imposed by others.

[6] Banerjee et al (2008) studied to monitor and assess the road traffic noise in its spatial-temporal aspect in an urban area. The paper discusses the observations, results and their interpretation based on the study. Noise recordings from site, collected from April 2006 to March 2006, were used for statistical analysis and generation of various noise indices. Noise maps were also created for impact analysis and formulation of Noise Risk Zones. Mean L_{dn} value ranged between 55.1 and 87.3 dB (A). Day time L_{eq} level ranged between 51.2 and 89.0 dB (A), where it ranged between 43.5 and 81.9 dB (A) during night. The study reveals that present noise level in all the locations exceeds the limit prescribed by CPCB. Based on the finding it can be said that the population in this industrial town are exposed to significantly high noise level, which is caused mostly due to road traffic.

[7] Omidvari, and Nouri (2009) investigated the amount of traffic noise dose received by traffic policemen in Tehran. The investigation was conducted during three consecutive months in 2007 in 282 locations of the main streets of studied district which are known for its heavy traffic, as well as population flow. The statistical results showed the significant differences between light and heavy traffic conditions and also the direct effect of heavy traffic on noise pollution, also it was shown that vehicles traffic is the main source of the produced noise pollution. The study created a related questionnaire which evaluated the traffic policemen behaviour from them and their relative's point of views. The results showed that noise pollution has damaging effects on their behavioural conditions and also, on their personal assessment. This study attempted to show that noise pollution in metropolises such as Tehran is a serious problem and it is should be treated as a top priority in the urban environmental management in order to reduce noise pollution.

[8] Pal and Bhattacharya(2012) examined the problems of reduction of individual's efficiency in his/her respective working places because of road traffic noise pollution in Agartala due to rapidly growing vehicular traffic. This paper deals with monitoring and modeling of the disturbances caused due to vehicular road traffic interrupted by traffic flow conditions on personal work performance. A relationship was developed between different traffic noise parameters and its harmful impact on work competency of individuals. Regression equations developed to predict the percentage of high annoyance among the individuals are fit based on noise parameters and parameters related to traffic movements. In addition, statistical analysis was also carried out between measured and predictive values of the percentage of highly annoyed group of individuals. The present model will draw the attention of the State Government and will help the policy maker to take the necessary steps to reduce this problem.

[9] Hunashala and Patilb (2012) studied Day-time urban noise quality assessment and also studied in Kolhapur for five critical zones viz. Educational, Commercial-cum-residential, Industrial-cum-residential, Recreational and Silence zone. Noise pollution indices viz. L_{10} , L_{50} , L_{90} , noise climate (NC), equivalent continuous noise level (L_{eq}), noise pollution level (L_{np}) and noise exposure index (NEI) were computed for all zones. Results indicated that the highest L_{eq} of 72.25 dB(A) was observed in 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. For educational zone, L_{eq} observed were above the statutory limits, while for other zones it was marginally below. The noise assessment study clearly revealed the alarming condition of noise pollution in Kolhapur.

[10] Ventouri et al(2012) researched in Athens city centre, both scooters and motorbikes operation patterns are analysed, in the basis of their environmental impact through ad-hoc tests to establish if specific features of their emitted noise are annoying and affect the quality of life. It resulted that PTW are a relevant cause of specific environmental annoyance on pedestrians when low background noise levels and sparse traffic flow allow identifying the PTW. Based on the results of a measurement campaign, both $L_{(max)}$ and roughness indices are identified as characteristic noise signatures of the PTW. Results are compared to laboratory studies on annoyance found in literature and to a specific set of interviews with a large number of pedestrians in selected sites. Annoyance caused by scooters and motorbikes is analysed in the findings and conclusions.

VII. CONCLUSION

Overall trend of the research papers show that noise pollution is becoming a severe problem. In the urban environment, the increase in noise levels has induced various pathological and psychological disorders in living organisms.

- A. Day to day increase in number of transportation facilities resulting in unbearable increment in noise pollution due to which various mitigating measures for urban traffic are being taken for noise pollution control unsustainable transportation planning.
- B. Road traffic and related noise is a major source of annoyance and impairment to health in urban areas.
- C. The effects on roadside noise levels has been observed after applying sound absorptive materials to the traffic face of noise barriers.
- D. The effect of disturbances caused due to vehicular road traffic on personal work performance has been monitored in various cases.
- E. Many case studies has investigated the amount of traffic noise dose received in a particular area.
- F. Noise acts like other stresses do and also its effects are far reaching affecting other body functions too along-with the hearing.
- G. There are some adverse environmental effects of noise, including psychological and physiological effects to those living in the proximity of this urban traffic.

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