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Noise quality assessment at selected locations of fergusson college road of Pune and its effect on urban population

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ABSTRACT

Nowadays noise is considered one of the major components of environmental pollution. Industrial development, increased commercial sectors and heavy traffic have resulted in increase in noise levels. Noise pollution brings about degradation of environmental quality which later creates health and communication problems. The present work was carried out to assess the traffic noise levels at three different locations of Fergusson College Road of Pune city namely Dnyaneshwar Chauk, Goodluck Chauk and Garaware Chauk. Noise level for six continuous days were recorded in morning, afternoon and evening. Twenty readings at each location for one period of the day were collected for the further analysis. The data collected was used to find out equivalent noise level (Leq) by using formula which is applied to any fluctuating noise level. The Leq level in three locations found in the range of 65 to 95 dB (A) and for most of the time was observed to be quite high as compared with Indian standards. It was also observed that the pollution levels goes high in morning and evening on urban roads, as people travel to and fro work places. The present research study is based on the expected relationship between traffic noise and its annoyance impact is correlated with health effects faced by the citizens who regularly work and travel in high traffic areas.

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KEYWORDS

Noise pollution;
Equivalent noise level;
Health effects;
Traffic.

INTRODUCTION

Noise as 'unwanted sound' is perceived as an environmental stressor and nuisance. Nowadays, noise pollution is considered as one of the main problems of urban communities which has many hazardous effects on the urban environment and may result in a great deal of cost on the society^[1]. Traffic can be considered as one of the main source of noise pollution in large cit-

ies^[2]. Transport noise is an increasingly prominent feature of the urban environment, making noise pollution as an important environmental public health issue^[3]. Noise as a pollutant produces contaminated environment that becomes a nuisance and affects the health of a person, his activities and mental abilities therefore noise pollution may be defined as unwanted sound, which gets dumped into the atmosphere without taking care to the adverse effect it may be having^[2]. The high noise

levels are associated with higher population density, human activities, traffic density and lack of greenery. Noise pollution in urban cities is steadily increasing over the years^[4] and the proportion of people exposed to noise is greatly increasing which can lead to the health hazard^[5].

Increasing number of road vehicles and electronic devices has created serious threat of noise pollution. Traffic noise is a typical area of conflict between individual mobility needs and legitimate societal aspirations for quieter lifestyles^[1]. Traffic Noise is the major source responsible for environmental annoyance and can be defined as all negative feelings of displeasure, disturbance, dissatisfaction and nuisance, associated with any condition and known by individual to adversely affect them^[3,6].

Traffic noise pollution has become a pervasive aspect of working and living environments in most urban areas of the world, especially those in developing nations^[7] over the last three to four decades. The escalating problems of air and noise pollutions caused by traffic are receiving top priority attention and resources from governments, private sector and the public all over the world as they struggle to control these negative environmental concomitants of transport systems^[8]. Research indicates that in all major urban areas of India, the mean noise level is more than twice the prescribed international limits^[9]. Traffic noise consequently suffer an array of adverse health effects which include socio-psychological responses like annoyance and sleep disturbance, and physiological effects such as cardiovascular diseases (heart and circulatory problems) and impacts on mental health^[10]. Prolonged exposure to noise levels above 70 dB (A) is common along major roads of urban environment and may lead to irreversible loss of hearing^[11]. When exposed to man-made noise, animals may suffer both physiological and behavioural effects^[12].

Pune city has experienced a very rapid growth rate in the socio-economic and infrastructures over the last decade. Various types of vehicle, automobile, cycle, rickshaw and religious activities etc. create tremendous noise at various points of Pune city. It is overcrowded by people of its own and by outsiders of nearby urban, suburban areas and districts. Since it is one of the leading economically developed cities of western,

Maharashtra with many offices and working places, noise pollution remains at its higher levels throughout day and reaches maximum at office hours. The city has been expanding in all directions and facing transport crisis characterized by level of congestion, noise pollution, traffic facilities, outdated transport infrastructure, sharply rising motor vehicle ownership and use, deteriorating public transportation facilities (i.e., Buses, Tempo. etc) and uncoordinated land use. The present research study is based on the expected relationship between traffic noise and its annoyance impact on exposed individuals who are the regular part of the traffic generated noise.

MATERIALS AND METHODS

Sound level meter (Model LUTRON, SL-4010) was used to collect the varying noise levels in decibel (dB). Sound level meter works on the principle of evaluation of sound pressure on a linear or weighted scale. This instrument is primarily designed for community noise surveys. A large digital display gives a single value indication of the maximum 'A' weighted RMS (root mean square) sound pressure level measured during the previous second. The basic parts of sound level meter include a microphone, amplifier, weighting network and display meter reading in dBs. The dB (A) measure of sound is universally described on a logarithmic decibel (dB) scale of 0 dB (threshold of audibility) to 140 dB (threshold of pain). The instrument calibration was achieved using manufacturer supplied pista phone calibrator capable of producing known sound pressure level. On this scale, a doubling of sound pressure corresponds to a six decibel increase in sound level. The human ear is, in general capable of detecting frequencies between 20 to 20,000 Hertz. The ear is more sensitive to high frequency sounds than to low frequency sounds. Because of this, the A-weighting network was developed and is applied to measured noise levels to mimic the ear's varying sensitivity to frequency where resulting noise levels are expressed in dB (A).

Three different locations of Fergusson College (F.C.) road of Pune city namely Dnyaneshwar Chauk, Goodluck Chauk and Garaware Chauk were selected for monitoring noise levels. Noise level for six continuous days were recorded in morning, afternoon and

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evening in monsoon season. Eighty readings at each location for one period of the day were collected for the analysis of equivalent noise levels (L_{eq}). The instrument was set up to record noise readings at fifteen seconds intervals during the twenty minutes monitoring period. According to Environmental Protection Rules, 1986 (Schedule- III) in respect of noise, all three locations are in the category of commercial zone and heavy traffic zones.

RESULTS AND DISCUSSION

The main contributor of noise pollution in Pune city is transportation. The noise data collected from three locations namely Dnyaneshwar Chauk, Goodluck Chauk and Garaware Chauk registered high noise levels in the range from 65 to 95 dB (A). Garaware Chauk is central and commercial place at Deccan gymkhana with heavy traffic throughout the day and encircled by many shops, offices, city dwellers etc. Dnyaneshwar Chauk and Goodluck Chauk are separated roughly by a distance of 800 meters and nearby a campus of Fergusson College on one side of these selected sites. As Fergusson College road is a one-way, maximum vehicles from urban, semi-urban and outstations arrive initially at Garaware Chauk and move towards Dnyaneshwar Chauk by passing through Goodluck Chauk. The maximum average equivalent values for the six continuous days at Dnyaneshwar Chauk, Goodluck Chauk and Garaware Chauk were 91.95, 92.87 and 93.95 dB (A) respectively. All the higher noise levels were observed in the afternoon. It was observed that motorcycles, auto rickshaws, scooters, buses, trucks, cars and city dwellers create noise pollution in all these commercial areas. In all of these commercial zones, the sound level is very high in comparison to permissible sound level of 65 and 55 dB (A) in day and night respectively as suggested by central pollution control board, Delhi (CPCB).

Substantial research works have been carried out on rail and road traffic noise, aircraft noise^[15] and their impact to the dwelling communities^[16]. Noise pollution has also been studied in cities^[17] and in industries like paper mills^[18], thermal power plants^[14], refineries^[19], printing presses^[20] and mines^[21]. Ravichandran et al.^[22], measured noise levels at selected place of Pudukkottai,

Tamilnadu, found that vehicular traffic and pressure hours are the main cause of noise pollution in the city.

The noise levels prevailing in commercial areas of Jabalpur city had been investigated by Pandya and Shrivastava^[23] where they found that the noise level data in commercial locations observed normal distributions with an average value of 75, 74, 88 dB (A) in morning, afternoon and evening respectively. Santra^[24] concluded that the level of noise in Kolkata city is much higher than the prescribed limit as fixed up in the standard mentioned in the Acts relating to noise pollution. Noise pollution of densely populated city of Buenos Aires was studied Bogo et al.^[25]. The effects of the exposure to occupational noise are longer for males than females in all sub-regions and higher in the developing countries^[26,34,35]. Similarly, traffic noise received by the inhabitants living at roadside mainly depends on distance from road, diurnal variation and character of the traffic and street configuration^[27,34,35]. 25% of the European population is exposed to transportation noise at over 65 dB (A) and more than 30% are exposed at night to noise levels exceeding 55 dB (A) and disturbing to their sleep^[28]. Surveys conducted in the past have revealed that noise levels in urban areas are generally much higher than recommended standards^[13,14,34,35]. Our values expressed in L_{eq} are in accordance with the values obtained by Pandya and Shrivastava^[23] and other workers. The levels of the noise are observed to be very high at all the three selected locations of the Fergusson College road and are enough high to damage the health of urban city dwellers, residents and workers.

Evaluation of questionnaire

The traffic noise measured at three selected sites of Fergusson College road is shown in TABLE 1. The minimum and maximum noise (L_{eq}) levels observed at the road were 87.27 and 93.95 dB (A) respectively. The source is predominantly attributable to motor vehicular traffic. The permissible level for noise in commercial area during the day time is 65 decibels dB (A). In the present investigation it can be seen that all the selected sites have surpassed the permissible limit suggested by central pollution control board (CPCB). The departure from prescribed limit is substantial and with this level on a chronic measure of time can cause definitive health problems to the exposed population. There

TABLE 1 : Traffic generated equivalent noise pollution level dB (A) at three selected sites of Fergusson College road, Pune

Sr. No.	Name of the site	Period of sampling		
		Morning	Afternoon	Evening
1)	Dnyaneshwar Chauk	87.27(±2.65)	91.95(±4.58)	89.72(±3.12)
2)	Goodluck Chauk	90.49(±4.89)	92.87(±3.98)	90.91(±2.57)
3)	Garaware Chauk	89.24(±4.75)	93.95(±5.91)	92.64(±3.54)

Each value is a mean of six days L_{eq} noise level and values in parenthesis indicates standard deviation

TABLE 2 : Ambient noise levels standards in L_{eq} applicable in India- central pollution control board (CPCB) standards

Sr. No.	Type of the area	Standards in (L_{eq}) in dB (A)	
		Day	Night
1)	Industrial	75	70
2)	Commercial	65	55
3)	Residential	55	45
4)	Silence zone	50	40

is a definitive risk of health impairment to the population, particularly for the shop-keepers, permanent residences and the travelers who are regularly facing the heavy noise levels on the road.

The noise pollution survey carried out by a questionnaire administered to 100 individuals traveling on F.C. road of Pune city, indicated that most of the people including vehicle drivers were aware about noise pollution but their health significance was not fully realized. 70% of the respondents were exposed to more than three hours of noise per day. When we asked about the higher levels of noise pollution, 90% of the people were of the opinion that it is increasing. 40% respondents were facing headache as the main health effect of noise pollution and 15% respondents visited the doctors for treatment of health problems. Some students of Fergusson College reported that their thinking process get disrupted by frequent air-horns. 40% responded that their heartbeats increases in the traffic especially at heavily noise polluted areas. When asked about the problems faced by the domestic animals, 70% were aware that the animals also have effects due to vibrations of noise and 30% said that animals try to go away from the noisy place and get frightened. Only 2% people were of the opinion that the cracks produced on the walls of the buildings were due to noise and 98% people were unaware of the fact that noise can also damage the non living properties. On asking them whether turning off their vehicles on red signal was necessary, 45%

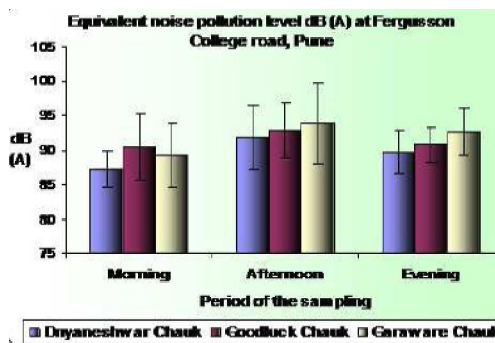


Figure 1 : L_{eq} at three selected locations of Fergusson College road, Pune

agreed to it but 55% said that they had no time to turn off and then turn on again to prevent time wastage and the pressure by the back traffic. 28% people agreed that they play a loud music in their vehicles sometimes whereas 5% do it always. We also asked the shopkeepers that for how long they get exposed to the noise pollution and its effect on their health. To this they told that they were continuously exposed for near about 8-9 hours a day and some of them were also suffering from headache and were facing communication problems for short intervals of the day. On asking the traffic policemen we got to know that 40% of them get irritated due to a long duration of exposure to noise, had some hearing problems and increased heartbeat during short period of the day. Very few of them were aware about the fact that there is a direct relation between increase in noise levels and stress. Some of them replied that the traffic noise makes them short tempered. In the present survey it was also observed that 95% people do not take any precautions when they are in high traffic hours while 5% use ear plugs to protect themselves from the ill effects of noise pollution.

Traffic is the most widespread source of environmental noise. Exposure to traffic noise is associated with a wide range of effects on human health and well-being. According to De^[29] 65 dB (A) noise level at a distance of one meter affects human heart while 125 dB (A) gives the sensation of pain in the ear and 150 dB (A) might kill a human being. Sharma^[30] also highlighted that the permanent loss of hearing at 100 dB (A). According to Santra^[31] high frequencies or ultrasonic sound above the normal audible range can affect the semicircular canals of the inner ear and cause nausea or dizziness. Some of the major health hazards caused by the

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noise as suggested by experts are permanent hearing loss, high blood pressure, muscle tension, migraine, headaches, higher cholesterol levels, gastric ulcers, irritability insomnia, increased aggression and psychological disorder^[32]. Tripathy and Patnaik^[33] reported various impact of noise stress on human health e.g. hearing impairment like temporary/permanent loss of hearing, trinitities, physiological impacts like cardiovascular constriction, gastrointestinal modification, respiratory modification, skin resistance alteration, headache, muscular tension, neurological disorder, paling of skin; task interference like reduced work efficiency, increased proneness accidents and lastly personal behavior like annoyance, anxiety, fatigue and fear.

Our results are in accordance with that obtained by the various researchers and there is an urgent need to have a definite and time bound action plan to be taken by the government with the involvement of non-governmental organizations and private stakeholder. Their contribution might help in reducing the excessive noise levels. As not all the sections of society were considered for survey and the sample size was limited to hundred people and some respondents specially of the road have not fully participated as they were not having enough time to reply in answering the questionnaire, the results of the study cannot be considered definitive but only indicative.

CONCLUSION

Environmental noise pollution has not been an entirely new phenomenon, but rather has been a problem that has grown steadily worse with time. Noise pollution is tremendously high in all the selected places of the Fergusson College, road of Pune city to adversely affect the welfare activities and working efficiency with health problems of its residents and travelers. It is almost certain, that problem of urban traffic noise pollution will soon assume a critical dimension and will be a cause of increasing concern for both public and responsible policy-makers. Many laws and acts have been amended to prevent the noise pollution but implementation of these laws is in vein. The findings suggest that there is an urgent need to act with and create special government body for strict implementation of legal measures under Environment (Protection) Act and Rules of

1986. The vehicle inspection program along with pollution under certificate (PUC) should also include inspection of vehicles for excessive noise. Various technological methods should be adopted to control high motor-emanated environmental noise levels in Pune. There is also a need to improve the urban public education concerning daily travel and its impact on welfare and health of the urban residents.

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