



DETERMINATION OF NOISE INVENTORY AND NOISE ZONING FOR KHULNA DISTRICT OF BANGLADESH

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Abstract: Noise is considered as a sound of independent loudness and an environmental pollutant, produces in conjunction with various anthropogenic activities and becomes hazardous to all living being. In this aspect, the research determined a noise inventory for urban and rural settings in Khulna District of Bangladesh and identified the relevant sources from which the noise produced such as urbanization, industrialization and motorization activities. Sound level meters and questionnaires were used for noise measurement and public perceptions regarding noise pollution in 2005 respectively. The research finds out higher values than the Bangladesh standard almost every sensitive areas like hospitals and schools. The identified noise-levels have the significant impacts on physical and mental health of the stakeholders particularly to the senior citizens, students and children. In addition, the research makes a comparison of noise levels between urban and rural settings, where the comparison shows that noise-levels are closely related with traffic volume, vehicles number, its quality and composition such as trucks, buses, auto rickshaws, construction activities, various machineries and other such tools and activities. The research also analyzes the people's perception on the noise effects of both urban and rural areas to find out a sustainable remedial measure. The health effects include suffering from headache, bad-temper, sleeplessness, aggravation, hearing problems and other relevant diseases.

Key words: Noise pollution, Khulna district, sound level meter, Bangladesh

Introduction

The noise refers to random sound phenomena, which interferes with communications or human process of concentration (Shukla and Srivastava, 1998). Noise or sound pollution is annoying, distracting or physically harmful to all living creatures. Scientists found that noise affects several aspects of children's behavioral and psychological functioning, including learning to read as well as their chronic stress levels such as annoyance, blood pressure, secretion of stress-related hormones, and mental health (Chowdhury and Baidya, 2005).

In Bangladesh, noise pollution is a major health hazard that may cause deafness to heart attack. On city streets, noise pollution is caused by hydraulic horns of vehicles (by buses, trucks and scooters) microphones and cassette players (Chowdhury and Baidya, 2005). Khulna City Corporation (KCC) and its surroundings are growing urban centers and a place of industrialization. The number of vehicles is also increasing day by day. As a result, noise is also increasing as a part of industrialization, construction site machineries, road traffic and indiscriminate use of loud

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speakers. Most of these noises exceed the acceptable level and creates annoyance, hampers physical and mental peace (Abel, 1990). However, very few studies have been conducted on noise pollution and its source inventory in all over the country. In this aspect, the study has an attempt to make a noise inventory of KCC and its surrounding areas. Moreover, the study includes the level of noise pollution in Khulna and analyzes its level of severity on human health.

Materials and Methods

A reconnaissance survey was conducted with individual respondents to obtain basic information of the study areas regarding objectives for designing and executing formal surveys. The Rural and Urban settings of Khulna district were considered for study area. Khulna City Corporation (KCC) has been considered as an urban setting and outside of this considered as rural setting (Fig. 1). Sampling points were located randomly at either urban or rural settings. The main factors in both cases of the study were the noisy areas. The research considered the public perceptions on the sources of noise pollution. In this study, two different models of Sound Level Meters were used. These are STANDARD ST-8850 Sound Level Meter (SLM) and Lutron SL-4010 Sound Level Meter (SLM).

Two types of questionnaire were developed for the study such as general and specific. Five groups i.e. students, general peoples, construction worker, transportation staff, and traffic police were under the specific questionnaire survey. General questionnaire was common for all interviewers. Under specific questionnaire the sampling area was divided into different zones such as residential, commercial and clinical area or sensitive area. In this study, three different time periods including morning (8.00 -12.00 am), day time (12.00 am - 4.00 pm) and evening (4.00 - 8.00 pm) both working and holiday were chosen.

There were 11 locations with 43 sampling points and 4 locations with 18 sampling points for primary data collection in urban and rural area respectively. At each point, at every five minutes interval, one person passing through the point was selected for interview. If there were more than one person in the fifth minute, then the third person was considered. If, the selected person was not interested for the interview, then the next person was approached. The collected data were processed, analyzed and interpreted for final presentation with the help of statistical techniques and equation with percentage and graphs. Again, the equation has been used for noise level calculation (Davis and Cornwell, 1998).

$$L_p = 20 \log 1/N \sum_{j=1}^N 10^{(L_j/20)}$$

L_p = average sound pressure level, dB re: 20 μ pa
 N = number of measurements
 L_j = the j th sound pressure level, dB re: 20 μ pa
 $J = 1, 2, 3 \dots N$

Results

Noise level at different areas of Khulna district: Noise levels were measured at some selected areas of KCC at every hour from 8.00 am to 8.00 pm. Only some specific sources of noise were found after 8.00 pm. Noise levels were measured at the point of sources and 15 m,

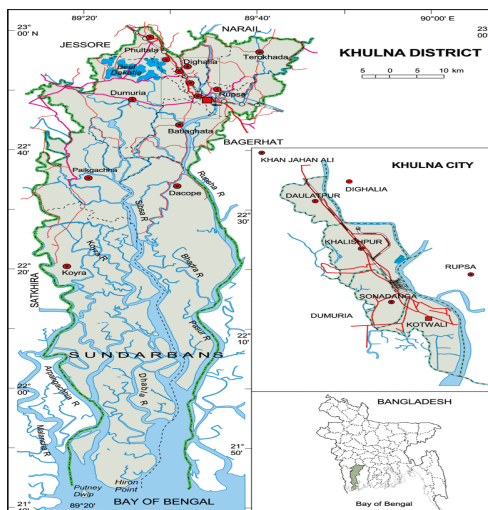


Fig.1. The sampling locations in and around Khulna district including the urban and rural settings.

30 m and 45 m distances from them. The noise level of different sources varied with distance from sources. The measured noise levels inside the vehicles were higher than outside. In the same way, noise levels were measured higher at the point of source than other distances. Some natural sources of noise were identified with acceptable noise level in a specific distance. The average noise levels and their variations with distance are away from the sources which indicate that the noise level reduces to acceptable level in sufficient distance from the sources.

Noise level in some important main roads of Khulna district: Noise level in working days was higher than that of holidays (Alam *et. al.*, 2000). However the noise level variations depend on time. Within three different periods, the highest noise level was found in Morning (8.00 -12.00 am) and Evening (4.00 -8.00 pm), those are commonly known as traffic peak hours. The lowest noise level was found in between 12.00 am - 4.00 pm i.e. day hours. It was also found that the roads near residential area such as Sher-e-Bangla Road, the noise variation was moderate between working and holidays. But roads in commercial and industrial areas this variation was very high. For example Klay Road in Dakbangla was very much noisy in working day but Friday it became more calm and quite than other days. Rupsa Bridge is now a very important site of communication in Khulna and an exceptional condition was found here. In working day the area was noisy due to vehicles and at holiday it was noisy for human gatherings. The noise level measured in every hour from 8.00 am to 8.00 pm in a major road in Khulna urban area. There were rapid variations of noise level depending upon time where lowest level 72.0 dB at 1.00 pm (midday) and the highest level, 93.0 dB at 5.00 pm.

Noise level in major urban residential areas in Khulna district: During survey, noise levels in most important urban residential area were collected in which the highest level was in Sonadanga and then Nirala Residential Area. In a residential area, the standard noise level is within 50 dB to 60 dB in day time and at night it is 40 to 50 dB. But in Khulna Urban area the noise level is found higher than the standard level at almost every time. Noise level during 8-12 am exceeds the average standard value (55.0 dB) of noise level. It was the situation in Nirala residential area of Khulna. In other residential sites, it was found that the morning hours (8.00 -12.00 am) and the first half of the defined evening time (4.00 - 6.00 pm) were noisier. In day time (12 am- 4 pm) the areas become less noisy.

Noise level in important commercial areas in Khulna: The commercial part of Khulna district includes the office areas and a lot of markets, vehicle station, rail station, Khalishpur, Dakbangla, KDA area and Rupsa. Khalishpur and Rupsa are the main industrial area of Khulna District having some manufacturing and processing industries. Noise levels of the markets, bus station and rail station were almost same in both days. The average standard level of noise in commercial area is about 65 dB (DoE). At Dakbangla commercial area noise level during office hour (8.00 am – 5.00 pm) exceeds the standard value of noise level. The highest average noise level, 84 dB was found at 11.00 am in most traffic zone. The lowest level of noise was found at early morning and off peak evening hour. Afterward, the noise level rose to 76.0 dB at 10.00 am. The noise level was raising and lowering continuously. After 5.00 pm while the official hour is closed the noise level sloped down rapidly and there was only 59.0 dB of noise at 10.00 pm.

Noise level in sensitive urbanized area in Khulna district: Some specific areas where people do not expect any noise generally identified as noise sensitive areas including hospitals, clinics, health centers and some educational and social institutes. The average noise level in Khulna Medical College (KMC) Hospital is 63 dB. In the same way, the measured average noise levels are 68, 65, 73 and 69 dB at Khulna Surgical and Medical Hospital Pvt. Ltd., Garib Newaz Clinic Diagnostic Ltd., Khulna Shishu Hospital and TB Hospital respectively. For sensitive clinical area the known average standard value is 45 dB from the DoE standard. But most of the Hospital and Clinical areas exceed the standard value of noise level in Urbanized Khulna. The highest (68

dB) noise level was found at 10.00 am in the morning and the lowest 50 dB was after 8.00 pm at night in KMC hospital. The day time within 1.00 pm to 3.00 pm the noise levels were in lower position.

Noise level of vehicles running in Khulna urban area: In the case of inside the vehicles the highest (95 dB) noise level was recorded in baby taxi and the lowest (65 dB) noise level was in car. From this study, it was found that in vehicles the noise was produced from two different sources, noise from hydraulic horn and then noise from motor engine. In Khulna region, hydraulic horn is noisier than other sources. Newly introduced vehicle “Volvo” has made relatively lowest level of noise.

Noise levels in rural areas in Khulna district: In Khulna district, the rural settings are found mainly outside of KCC area. The study areas which have been selected at rural site of Khulna are different one to another and the locations have been divided into residential, commercial (Bazar, hat, working field and others), and mixed area. In rural area, it is rare to detect noise sources after 7.00 pm at night except some occasions such as marriage ceremony, religious activities, festivals etc. The highest noise level (77 dB to 80 dB) was found from tractor in agricultural field.

Noise level from transportation system in rural Khulna: The traditional transportation systems produce less sound in rural areas. But at present time, some heavy vehicles and motor engine are found in rural areas which make noisy condition. For example, motor cycle has produced 90 dB, engine van 66 dB, Nosimon (local name of motor vehicle) 68 dB and tractors which are used in commercial area have made noise level 80 dB, but because of the lowest number of vehicle transports and short duration the noise levels are lower than other area.

Sources of Noise at Different Area of Khulna District

Identified sources of noise at urbanized Khulna: Motor vehicles are mainly responsible for the noise pollution. Most motor vehicles running in Khulna use hydraulic horn. People are disturbed by this hydraulic horn seriously (Alam *et al.*, 2000). Construction activities like piling, mosaicing, brick breaking etc disturb in newly developing areas. The shouting of road hawkers also disturbs the people in residential area. Miking used for religious activities, political activities, and advertisement is also nuisance to the people. Up roaring and over crowding from *kacha* bazar cause serious noise pollution. Different types of industries are situated in Khalishpur and Rupsa that cause serious noise pollution. During night hours, dwellers in residential areas are disturbed by noise pollution due to whistling of night guard and barking dog. The residential areas or commercial areas near railline and mills or factories are also experienced by noise pollution producing from movement of people or movement household’s materials in upper floor, loudly talking, children crying and their toys, high volume music from cassette and CD, television etc. In commercial area, motor vehicles, meeting, overcrowding are the most prominent noise sources.

In clinical areas, along with motor vehicles and construction activities the most prominent noise sources are crying of relatives, patients balder dashing, movement of trolleys, public movement, loudly conversation etc. According to the interviewers with dwellers, 98% of the interviewers claimed the vehicles are the sources of noise. Moreover, 43% of the interviewers have claimed that construction activities are responsible as the sources of noise pollution. According to the 50% of the interviewers, miking using in religious activities, advertisement, political activities, is also nuisance to the dwellers in residential areas. About 25% of the interviewers have claimed the miking is as the source of the noise pollution. About 32% of the interviewers judge that overcrowding is noisy to dwellers.

Invented noise sources in urban commercial area of Khulna district: According to the interview with people in commercial areas, 95% of the interviewers have claimed the hydraulic horn of

motor vehicles as the sources of noise pollution. About 75% of the interviewers have claimed the miking as noise sources. Moreover, about 68% of interviewers treated overcrowding as one of the noise sources. So, about 25% of the interviewers have claimed the music as the sources of noise pollution. According to about 45% of the interviewers, public demonstration is one of the sources of noise pollution.

Invented noise sources in urban clinical area of Khulna district: About 60% of the interviewers have considered the overcrowding as the sources of noise pollution. Many visitors coming to their patients, up roaring of the hospital staff are responsible for these overcrowding. Although 98% of the interviewers in commercial areas and residential areas have claimed the motor vehicles as noise but in the clinical areas, it is only 55%. Moreover, balder dashing of the patients has been claimed as a noise sources by 30% of the interviewers. About 25% of the interviewers have claimed the trolley as noise source.

Invented noise sources in rural area of Khulna district: According to the interviewers with dwellers, 58% of the interviewers claimed the vehicles as the sources of noise. Moreover, 43% of the interviewers have claimed the construction activities as the sources of noise. Different types of construction activities create noise but most of the people said that rural construction activities were not noisier. About 10% of the interviewers mentioned that miking using in religious activities, advertisement, political activities, is also nuisance to the dwellers in residential areas.

Effects of Noise Pollution in Khulna District

Effects of noise pollution on health: The impacts of noise pollution on human being are now an alarming issue in medical science. Noise causes a lot of difficulties to human health. In this research it had been tried to find out the noise effects for the people of Khulna district and to analyze the present situation. People of different areas are affected by noise in different scale in Khulna. During the survey it was found that the highest proportion of interviewer was suffering from different psychological disturbance. It was found that urban people were more sufferers. At residential part of urban Khulna, noise effects was relatively low than commercial and Industrial area. The people related with commercial and Industrial area have suffered much. Aggravation and bad temperament are greater problems according to the calculated result of the survey.

Effect of noise pollution on different age group: People of different ages are affected in different scale. This study has shown that those people are affected more who are involved in different commercial and industrial area for long time. The tolerance levels of different people are not same. It is divided the interviewees into different age groups such as <20, 21-30, 31-40, 41-50, 51-60 and >60 years respectively. It is found that people under twenty years old are less affected by heart disease and high blood pressure, but they have suffered from headache and some other abnormality such as sleeplessness. The noise pollution has become more effective for aged people (Miller, 1979). A person, who exceeds sixty, may suffer from high blood pressure and heart disease with higher sound level.

Noise pollution affects the general people in urban area: In general public survey, 68% were male and 32% were female. The respondent were mostly young, with 50% aged from 21-30 (years) and a further 27% from 31-40. Almost all those interviewed felt that noise pollution is a problem, with less than 3% saying that noise pollution is not a problem. The problems they most commonly mentioned as experience were bad temper (76%), headache (71%), aggravation (49%), difficulty concentration (43%), trouble sleeping (48%), hearing problem (35%) and some other physical problems. Women were more likely than men to mention bad temper (80% Vs. 69%), headache (45% Vs. 42%) and less sleeping.

Effect of noise pollution for rural people in Khulna district: In rural area, large number of general people is illiterate; they don't feel noise as a problem. Most of the respondents were students. There were some aged people who were within 50 to upper 60 years, had been suffering from hearing loss. But they said that it had been caused for lack of proper treatment and medicine.

Noise pollution is harmful for students in Khulna: From the survey in schools, colleges and University area, it has been found that noise pollution is very much unbearable in almost every situation. Significantly, almost all students, 93% of both girls and boys said that their studying is disturbed by honking. While this survey could not measure the extent of the disturbance, the finding is certainly troublesome that the ability of the students to concentrate on their studies that is regularly affected by noise pollution. The students in different stages have experienced a range of problems from noise pollution, including aggravation (70%), headache (76%) and difficulty concentration (65%). Girls complained more of headache (60% of girls' vs.53% of boys), bad temper (70% girls vs. 65% boys), and aggravation (57% girls vs. 55% boys) while boys were more likely to complain of problems of hearing (33% vs. 29%).

Noise pollution affects the transportation staffs: From this study, it has been identified that 82% people related with transportation system are seriously suffered from different noise induced problems. 63% of the transportation staffs are suffered from headache and 55% of the identified people are in problem of hearing loss. Most of the transportation staffs, about 80% feel bad temper and have suffered much. The aged staffs said that they didn't feel bad due to noise but most of them are suffered from different physical and mental problems.

Noise pollution affects the construction workers: In both urban and rural areas construction workers are commonly sufferer from noise pollution. Most of the construction workers said that they feel bad temperament during working hours. They work about 9-10 hours in every day in noisy environment. Because of staying long time in unbearable conditions, they have been affected and suffered from physical and mental disturbance. In rural areas workers are relatively safe because of using less heavy instruments. It has been found that highest numbers of workers (about 80%) are affected by bad temperament and headache. They also suffer from aggravation and hearing loss.

Noise pollution affects the traffic police in urbanized Khulna: Traffic police have suffered from noise pollution such as more heart beat, blood pressure, headache, sleeplessness, bad temper. Traffic police work more than eight hours in road sites which are the noisiest area in urban settings. Eighty percent traffic police said that they had been sufferings from a lot of physical and psychological problems, 20% answered no problem and while 5% did not comment on the question. Most of the traffic police said that their main problems are headache, hearing loss and sleeplessness. From the survey, 65% of the respondents are affected by headache. Sleeplessness is more or less common problem for traffic police.

Discussion

Comparative analysis of noise pollution and its impacts in rural and urban settings: The final goal of the study was to make a comparative study of noise pollution between rural and urban settings in Khulna district. From the study the sources of noise, the measured noise levels and finally impacts of noise on human varied with the characteristics of the areas. The variations of noise levels in different locations of both urban and rural areas are shown in the Table 1.

Table 1. The variation of average noise level between two selected areas, urban and rural in Khulna district

Location	Urban Area Noise level (dB)	Rural Area Noise level (dB)
Residential area	70	56
Commercial area	82	65

Educational Institute	78	59
Hospital/Clinic area	72	50
Industrial area	80	66
Road Side	85	60

Sources: Survey, 2005.

According to the interviewers in urban area with dwellers, 90% of the interviewers claimed the vehicles in transportation system as the sources of noise. At the same time only 50% said that transportation system creates noise in rural area. Moreover, 75% of the interviewers have claimed the construction activities as the sources of noise pollution in urban area. But it was 48% only in rural area. Different types of construction activities including mosaicing, pilling, and brick breaking etc. cause serious noise pollution in newly developing urban areas. On the other hand, rural area was relatively free from these sources. According to the 80% of the interviewers in urban area, miking using in religious activities, advertisement, political activities, were also nuisance to the dwellers.

Noise pollution causes health hazards in both rural and urban area in present situation, but it was true that the sources of noise have found limited in rural area. So the health effects from noise were relatively low in rural area of Khulna District. This comparative study has been identified from the Fig. 1.

Figure 1 expresses that the sufferings due to noise pollution in rural area is much lesser than that of urban area. From the interviewers, in urban area 76% respondents feel bad temper where in rural area the rate is 40% only. Other problems are higher in urban area including headache (urban 71%, rural 23%), sleeplessness (48% Vs 8%), hearing problem (35% Vs 30%) etc.

Conclusion

Noise pollution is a serious but neglected issue in all over the country especially in Khulna. The main sources of noise pollution are vehicles like auto rickshaws, hydraulic horns, trains and different workshops, which are the major components of urban life. Yet the rural area of Khulna district is comparatively less noisy compare to urban settings. Thus the impacts of noise pollution are limited in rural areas due to its natural environmental condition and traditional life style. The major health effects of noise pollution in urban settings are hearing problem, bad treatment and headache, psychological disorder etc. The research concludes that the noise-levels in urban settings of Khulna District are increasing day by day that brings more hazardous to the stakeholders in the coming days. The research suggests government as well as different socio-cultural organizations such as NGOs, the media peoples, and other local, national and international organizations should come together to aware the community peoples and take appropriate initiatives to reduce the problem for a sustainable social life.

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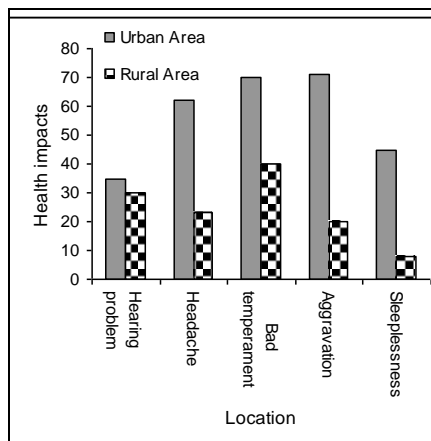


Fig.1. Comparison between the impacts of noise on human in rural area and urban area of Khulna (Field survey, 2005).

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