



Spatial pattern of community noise level in Bahawalpur City

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Abstract

Like many other problems in urban areas, noise pollution in the city of Bahawalpur is emerging as a major threat to the health and peace of the resident. In order to understand noise level intensity and distribution pattern, the current study is focusing on the level of noise pollution in the selected points along the major roads in the city during various peak hours of the working day. For this purpose level of noise pollution was measured on the twenty five various localities in the city using sound level meter. The primary data was represented on the map by using the Inverse Distance Weighting Technique showing the level of noise pollution of the nodal points in the city. Pattern of noise pollution indicates that there is a strong relationship between the number of vehicles and the level of noise pollution in the city. It was found that the noise level was higher along the nodal points having more traffic flow during the peak hours. Current study reveals that the level of noise pollution is high on the selected localities as compared to the environmental standards of environmental protection agency. The study is helpful in determining the peak hours of traffic which makes these localities more vulnerable for noise pollution.

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Introduction

Any unpleasant change in the natural environment which has a negative impact on the environment is termed as pollution. Any unpleasant sound produced by human being or machines is referred as noise pollution. The word noise is related to the Latin word "Nauseas" which mean seasick ness (Zubair & Siddqui, 2011). In the major urban areas, community noise problem is a major issue to be understood and mitigate. Community noise can be termed as, residential noise, domestic noise or environmental noise except the noise emitted from industrial workplace. The major source of community noise is rail, road, and air traffic, different activities of people i.e. the use of pressure horns, use of crackers, fireworks on different occasions, construction of buildings, noise emitting from cafeteria, restaurants and like the use woofers. Noise pollution are given least priority as compare to the other type of pollution of modern world (Pandey *et al.*, 2014). Any urban area having the unplanned traffic routes may results increase in noise level in the urban area. Keeping in view that as most of the traffic routes in urban areas are within or along the residential areas thus creating threat to the inhabitants of the residential areas, a silent killer called "Noise" (Adjeboi & Samson, 2012). Noise is one of the ubiquitous environmental hazards of modern world. It originates from the various sources but road side traffic is the major source of noise in urban areas. It is estimated that about 60% of European population is suffering from this environmental hazard (Khan *et al.*, 2010). Noise pollution is just like a wave which widespread in environment. Noise pollution could be regarded as pollution of energy because it is always in the form of waves. These irregular waves could be the cause of great disturbance for human beings and its greater intensity can gift more harm to the human (Olokooba *et al.*, 2010). Noise is a universal environmental threat of the modern world, creating from a huge variety of sources in which traffic is at number one. And the cumulative musical gadgets, drums, crackers are the main basis of noise pollution. A study was conducted by (Obiefuna *et al.*, 2013) in Calabar Metropolis city of Nigeria.

Spatial interpolation IDW is used to display the point data on the map. The map shows that the level of noise tend to increase from morning period reaches at its peak level in the noon and again start to drop in the evening. The Taiwan city expanding its boundaries rapidly not only in terms of population but the use of modern technology, increase in number of vehicles, heavy machinery used by the inhabitants of the city not only increasing the noise level but also making the quality of air worse in terms of sustainability (Wen & Chang, 2008). GIS technology is useful as it provides the opportunity for the city planners to mitigate noise level in and around the urban residential areas as the maps showing the level of noise pollution providing the best and accurate information about the sources and risk zone of noise pollution (Laaly-Sankari *et al.*, 2010).

The aim of the current study is to investigate the level of noise in the residential areas of Bahawalpur City along the main circular road due to high incidence of traffic. Noise is a disturbance to the human environment that is intensifying at alarming rate due to increase in use of personal vehicles. Current study provides level of noise pollution in the city which is helpful for future researchers and urban planners. The aim of the current study was to highlight the risk zones of noise pollution; which will be helpful for urban planners and human well-being.

For this purpose spatial pattern of noise in the residential areas of the city has been identified. The study has identified the hotspots of noise pollution in the residential areas along the main roads of the city. These hotspots can play vital role in future planning of the city development. The city developers can plan the extension of city keeping in view the population and traffic congestion in order to minimize the adverse effects of noise pollution on the community.

Materials and methods

Study Area

Bahawalpur is located on 29.9833° N longitude, 73.2667° E latitude. It is the 12th largest city of Pakistan (Shafqat *et al.*, 2014).

It has shown a tremendous urban growth of more than five percent per year during the last inter-census period between 1981-1998. According to the census of 1998 the total population of Bahawalpur City was 408395 while presently the total estimated population of the city is more than seven hundred thousand.

Data Collection

To conduct the present study the primary data on the noise level was collected by using sound level meter. In order to cover the objectives of current study, twenty five nodal points were selected from the study area. The main nodal points were considered as sample points from the residential areas along the major roads of the city. Data was collected in the morning, afternoon and evening on the same nodal points in order to draw the comparison of noise level during different time intervals. Data was collected in the month of October 2014 at 8:00 am to 10:00 am, 1:00 pm to 3:00 pm and 5:30 pm to 7:30 pm for morning noon and evening time respectively. Data collected on working days of week i.e. Monday to Friday.

Data Analysis

After collecting the data the average value of each nodal point was calculated. Then the levels of noise pollution on the selected localities were represented with maps using the Inverse Distance Weighting (IDW) Technique. This technique is widely used in all over the world to represent such kind of point data as it provide the opportunity to assigned average value to the unknown neighborhood point of the measured points. It is also helpful in order to depict the average values of sample points on the map giving a 2D view of sampled area.

Results and discussion

The results of the research reveal that the average value of noise on the selected localities is more than 72 dB. This value is more than the permissible limits of Environmental Protection Agency for outdoor noise guidelines. The highest noise level was recorded at noon time 98.5dB while lowest at evening time having the value 67dB. The highest noise level recorded at morning time was 86dB while lowest 57dB. It was observed that the noon is the time when the noise level was highest in the most of the nodal points. Out of the total 25 nodal points at least 11 points were having noise level more than 80dB which is far higher than the permissible standards given by the EPA. Similarly at all points the noise values were more than 70dB. It is desirable to have relatively lesser values of noise level during the night hours. More than half of the nodal points were having the noise level of more than 70dB which is above the acceptable standard values. It is worth mentioning that the highest value recorded at evening time was more than 90dB. The noise level was highest in the vicinities of general bus stand having average of more than 90dB most of the hours during the day. Similarly Dubai chowk, melad chowk, Sariki chowk, one unit chowk, kali puli and library chowk were having the noise level more than 70dB on the average of three different time periods of the day. It is worth mentioning that the two relatively considered silence zones are BV Hospital and University Chowk were having the values of more than 72dB and 76dB respectively (Khan, 2014).

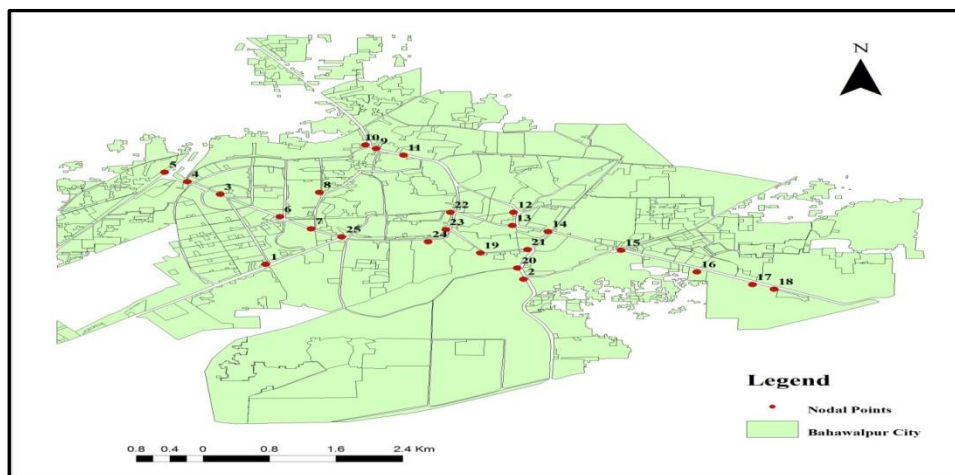


Fig. 1. Sample Sites of Noise Pollution.

Table 1. Sample Sites.

Sr. No.	Nodal Point	Sr. No.	Nodal Point
01	Dubai C.	14	Sadar Pulli
02	Purani Chungi	15	One Unit
03	Welcome C.	16	G.C.T C.
04	C, Near Station	17	Husaini C.
05	Station	18	Melay Wali G.
06	Saraiki C.	19	C.M C.
07	Melad C.	20	Fauji Basti
08	Tanki wala C.	21	Kali Pulli
09	Lari Ada	22	Farid Gate
10	City Hotel C.	23	Library C.
11	Niazi Ada	24	Shoba Hadsat
12	Uni C.	25	C. Fawara
13	D.C Chok		

Source: Field Survey 2014.

Risk Zones in the Morning

Risk zone can be identified on the bases of level of noise pollution in the area. During the study it was found the most of the selected localities the level of noise pollution was very high as compared to prescribed standards of EPA. The main risk zones in the morning were the General Bus Stand, Niazi Adda , Farid Gate, Sadar Pulli and Library Chowk as all these points were facing the level of Noise more than 75dB during the morning time from 8:00am to 10:00am. General Bus Stand and Niazi Adda providing inter and intra city transportation facilities to the inhabitants and visitors. Both these points are located on the entrance of Bahawalpur City in the northeastern side of city.

Due to the presence of buses, auto rickshaws, motor cycles, pressure horns used by the vehicles and the announcements made by the different bus stands play vital role in increasing the noise at these localities. Another important risk zones in the morning were Library Chowk, Farid Gate and ends at the Sadar Pulli covering the University Chowk and DCO Chowk.

These localities are characterized by the presence of educational institutes, banks and offices along the main circular road ranging from Library Chowk to the Sadar Pulli. In the morning on these localities the peak hour for traffic congestion is around 8:00am to 9: 00am as the official timing of school, colleges and offices start from 8:00am. Pak Maktab, APVA High School, Technical High School, SD High School, Vocational Institute, SE College, The Islamia

University of Bahawalpur are responsible for high level of noise in this zone during the morning time. While from 9:00am to 10:00am different Government and Private Banks and Commercial Centers starts their activities thus bringing the level of noise pollution to an alarming extent in the morning time. In the morning average value of noise on these localities were around 78.98dB i.e. more than recommended level of noise proposed by the EPA.

Risk Zones in the Afternoon

The level of noise tends to reach its maximum value of more than 75dB on almost all localities in the afternoon as it is the closing time of educational institutes and offices. During these hours of the day traffic congestion is maximum on twenty nodal points of the city. The maximum value of noise was observed at General Bus Stand i.e. 98.5dB. This is the busiest place of the city in term of transportation thus level of noise is on higher side as compared to the other areas of city. Next to General Bus Stand is Farid Gate in terms of noise level in the afternoon. The level of noise is around 84.6dB due to the traffic congestion. This point is almost in the center of the city and the entrance point of main bazar of Bahawalpur City. In the afternoon on the Railway Station of the level of noise is around 82.4dB due to the arrival and departure of trains, announcement by the loud speakers at the station and due to the presence of different vehicles like auto rickshaws, motorcycles, cars etc. on the railway station used to pick and drop the passengers. The average value of noise level on twenty localities out of twenty five was around 81.26dB.

Risk Zones in the Evening

The level of noise tends to drop on most of the localities as compared to the morning and afternoon. In the evening only five nodal points have the level of noise more than 75dB. Among these five localities again the General Bus Stand and Niazi Adda were on top as level of noise was 92.3 dB and 83.7dB respectively in the evening.

In the evening the railway station also remains the busiest place in terms of transportation thus ultimately increasing the noise level from the

approved values of EPA. In University Chowk the level of noise is around 75dB due to the presence of printing and stationary shops, food points in this area. Apart from these five localities there are some nodal points along the main circular road which having the noise level more than 70dB in the evening like the Chowk Fawara, Sariki Chowk and Welcome Chowk. The level of noise is on higher side in these nodal points due to the presence of food points and shopping centers. The average value of noise on all the five localities were around 81.8 dB in the evening.

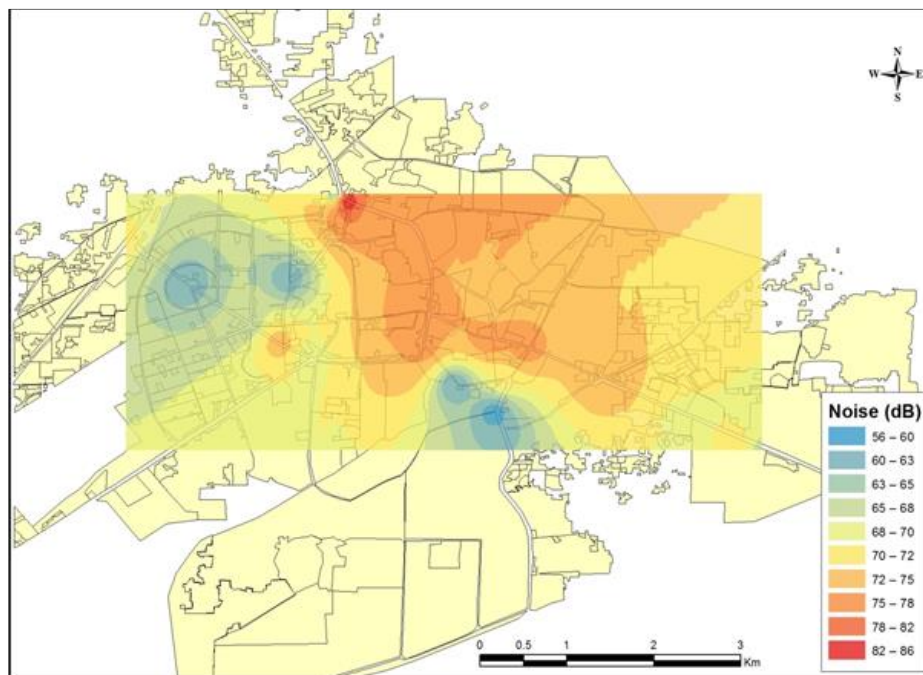


Fig. 2. Level of Noise Pollution in Bahawalpur City (Morning, 08:00 to 10:00AM).

Noise Mapping using IDW.

Northeastern side is one of the busiest places of the city in terms of transportation due to presence of educational institutes, offices and the general bus stand. The dark red color in the map showing the highest level of noise pollution i.e. 82-86dB on the general bus stand and that is on higher side as compared to the other areas of the city in the morning time which means the residential areas of northeastern part of the city are facing the problem of noise pollution. Due to the presence of heavy transport all the time on the general bus stand the level of noise pollution is very high as compared to the other areas of the city.

Next to general bus stand there is a zone of educational institutes and offices starts from the Farid Gate and ends at the University Chowk. In this zone the level of noise pollution is around the 76-82dB as number of heavy vehicles ranging from motorcycle, auto rickshaws, cars, vans of different school and college drop the children's in their respective institutes in the morning time. It is obvious from the map that the residential areas of Model Town A, B and C are safe from the noise pollution as compared to the other areas of the city. The level of noise pollution in these residential localities is around 50-63dB in and around the main Chowk's.

Similarly the localities of around the southeastern side of the city also has the low level of noise pollution as these areas are the residential areas of labor class and mostly they went for their work early in the

morning using their own bicycles. The level of noise pollution during the morning time is shown on the map below.

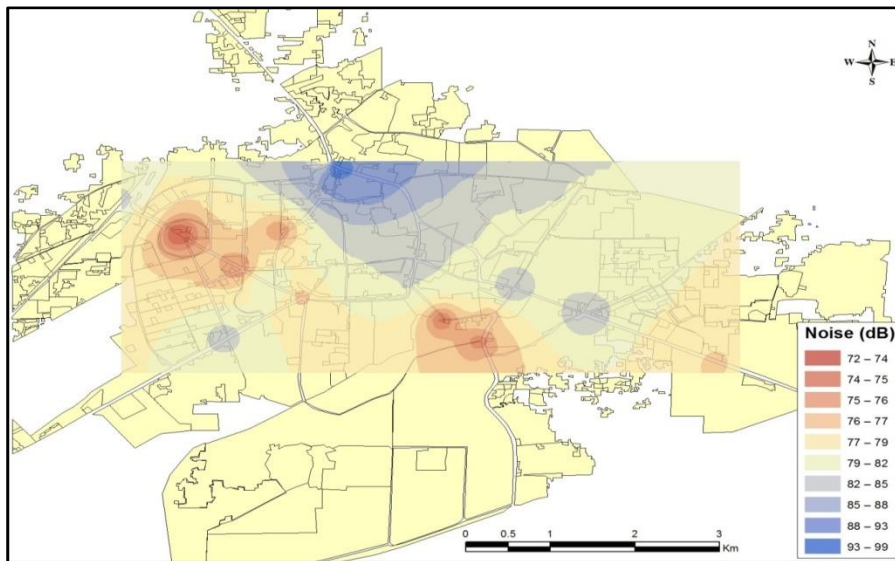


Fig. 3. Level of Noise Pollution in Bahawalpur City (Afternoon, 1:00 to 3:00PM).

The level of noise pollution for the time period of afternoon is shown in the Fig. 3. Northern part of the city is characterized by the general bus stand that's why the level of noise pollution at general bus stands and in surrounding areas is on higher side as compared to the other areas of the city. Similarly after the general bus stand the level of noise pollution around the educational institutes and near the offices is high as it is the off time of educational institutes and offices.

At this time the flow of traffic is very high in this area that's why these areas suffered with noise pollution. The level of noise pollution is about 98.5 dB at general bus stand and in the adjacent areas of general bus stand while the residential areas that are located in the southwestern part of the city have the low level of noise pollution. The flow of traffic in these areas is not so high as compared to the other areas of the city due to the absence of educational institutes and offices in these localities.

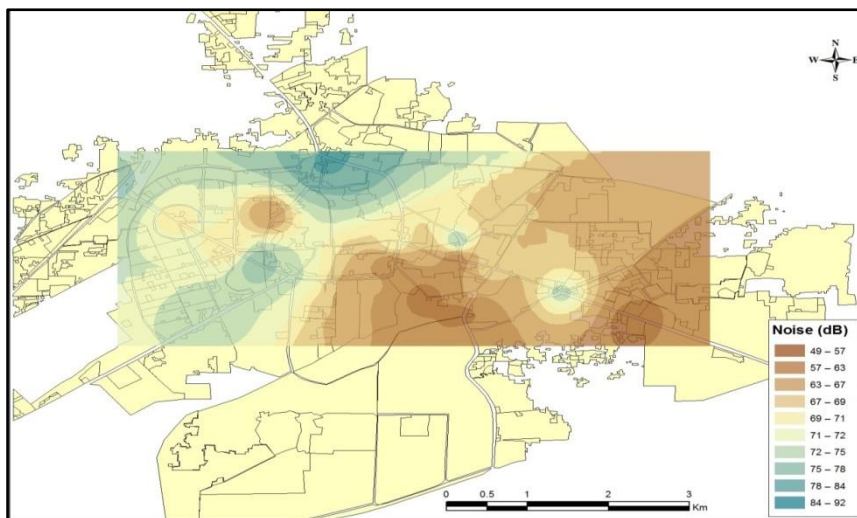


Fig. 4. Level of Noise Pollution in Bahawalpur City (Evening, 5:30 to 7:30 PM).

As it is obvious from the map of morning and afternoon time that the level of noise is higher around the adjacent areas of general bus stand, educational institutes and offices but in the evening time apart from general bus stand there is a slight difference in the variation of level of noise in the selected localities of the city. This variation is due to the change in activities of the inhabitants of the city.

The level of noise pollution in the evening time is also on higher side on the western side of the city as shown in Fig 4. In these areas the flow of traffic increased as compared to morning and noon due to the presence of hotels and fast food centers. The people like to visit the recreational points in the evening time when they have spare time to do so.

As a result of this change in the flow of traffic the level of noise pollution is slightly higher in the west, northwestern and southwestern part of the city. However the residential areas located in these parts of city have moderate level of noise pollution as compared to the other areas of the city as these residential areas are still on a marked distance from these recreational points.

Most of the recreational points are located along the major circular road like Zanzibar, Almida, Desert Grill, Lataska, Waseeb, Chicken Cottage and other food points as well. While on the other hand the level of noise in the southwestern part of the city is on lower side. This is due to the absence of hotels and fast food centers in these areas.

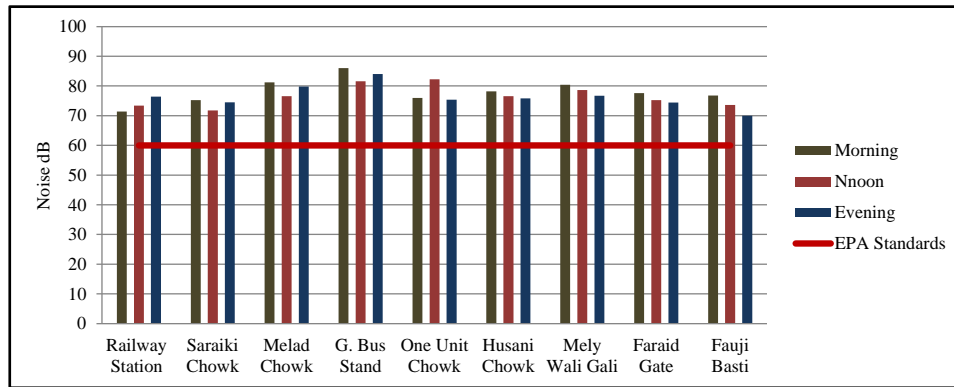


Fig. 5. Level of Noise Pollution on the Selected Localities in Bahawalpur City.

The highest value has been observed at General Bus Stand, Farid Gate, One Unit and Husani Chowk not only during the morning time but also afternoon and in the evening the level of noise pollution is very high. General Bus Stand is one of the busiest places of the City. As it provides the transportation facility to the inhabitants of city that's why the level of noise pollution is very high as compared to the other places. On the other hand noise produce by the rail engines and loud speaker used over there for announcement are responsible for noise pollution at railway station. Similarly level of noise pollution on One Unit Chowk and Farid Gate during the afternoon is also very high as compared to the other places. The recorded value shows that level of noise pollution on the different localities shown in the graph is very high as compared to the standards of EPA.

According to the EPA standards the level of noise pollution of the road having two or more than two lanes must be less than 60dB during day time while during night time it should be less than 55dB.

Conclusion

Anthropogenic activities are responsible for environmental degradation such as urbanization, use of fossil fuels, modern technology and high density of traffic etc. Data reveals that the level of noise is higher than the permissible limits of EPA. The city developers must look into this matter on a serious note as this noise is putting stress on the local community particularly the inhabitants residing in the adjacent areas of the selected localities. There is a dire need of a ring road in the city in order to divert the flow of traffic particularly the flow of intra urban

transport from these localities, This diversion will be helpful in bringing the level of noise to somewhat within or near the permissible limits of EPA. These environmental problems can be controlled by the proper planning and by the implementation of the rules and regulation proposed by the EPA and WHO. Yet another simple and most effective way of reducing the environmental pollution is the urban greening. City must have properly planned green spaces for the inhabitants. As the green spaces play a vital role in reducing the environmental pollution and also increases the aesthetic sense of the city.

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