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Measurement of Noise Level in Urban area; A case study of Bahawalpur City, Pakistan

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Abstract: The urban noise pollution is a global problem that creates the mental, social and health problems. This study measured the noise level of Bahawalpur City in 2013, compares with standards and analyzes the spatial temporal distribution of noise level in study area. 21 samples were selected from the commercial areas of the Bahawalpur City. The data was collected by using a digital sound level meter in different times is day (morning, afternoon, evening) from 19 to 23 October. The structured questionnaires were filled through random sampling technique. The data were analyzed in SPSS software and apply different techniques such as Chi-square, mean, standard deviation, level of minimum and level of maximum. The data was compared with standard and measured the spatial and temporal distribution of noise level through GIS techniques such as interpolation, Kriging, Charts by the Arc GIS 10. The results show that the rate of noise is high in study area. The level of maximum noise is pollution in morning was 106.8, maximum noise level in afternoon was 115.4 and maximum noise level in evening was 110.2 it's exceeding with the standards. The present study suggests to increase the green space, government should launch a media campaign to raise awareness on control the noise pollution. This study is helpful for urban planning and decision making in protection departments.

Keywords: Noise pollution, Sound level meter, GIS, kriging, spatial temporal

1. INTRODUCTION

Noise can be defined as the unpleasant sounds which cause trouble to society. Prolonged exposure to excessive noise has been proven physical and psychological damage. The noise is a major source of friction between individuals. (Subramani *et al.,* 2012).

Noise is the fundamental problems of our world today and a great multitude of people work or live in this abuse.Now a day's most of the cities are sources of noise pollution in particular immense transportation and industries in urban environs (Subramani *et al.,* 2012). Unfortunately, noise pollution may increase hearing impairment, restlessness, decreased work efficiency, and the impact on cardiovascular effects of mental health(Kumar., 2011). Geospatial Information System (GIS) as a powerful and effective tool to collect, store, retrieve and analyze noise pollution information. And a powerful hand tool to work with digital data in geospatial information system. (Gharagozlou *et al.,* 2013).

The noise directly affects the auditory and non auditory systems of human body. Noise effect has various consequences on the mental health and physical disruption of daily activities that can affect sleep, conversation, lead to the perception of discomfort and increases the chances of illnesses such as headaches, the hypertension, heart failure and hearing damage etc (Kumar., 2011).

The explosive increase in the number of vehicles and high speed road vehicles cause more problems to the surrounding areas. About 120 million people in the EU are bothered by the noise above 55 dB traffic, and more than 50 million people are exposed to greater than 65 dB noise levels. (Alesheikh and Omidvari., 2010)

Table 1 Permissible noise level

Area	Noise level (dB) in Day	Noise level (dB) in Night
Residential	55	45
Commercial-residential	60	50
Commercial	65	55
Residential-industrial	70	60
Industrial	75	65

Study Area

The city of Bahawalpur is located in southern Punjab near the banks of the Sutlej River. Bahawalpur City area is 2,372 square km. The absolute location of Bahawalpur city is limited between 29 ° 23'44 "N 71 ° 41'1 " E. The elevation of the study area from sea level is 152 meters. According to data from the United Nations in 1998, 408,395 people in the study area Bahawalpur City, at the risk of the high level of noise pollution due to the increase in motor cars, poor network and inadequate distribution of commercial and residential areas. Similarly, amassive increase in the number of motor carsand inadequate street widening, especially in the city center, has led to traffic congestion in the city.

2. MATERIAL AND METHODS

This research focused on 21 selected chowks to check the level of noise. The primary data were

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collected by using a digital sound level meter model EXTECH 407730.The data were collected from Mala Wali Gali, Hamatia Chowk, Govt. Technical Collage, One Unit Chowk, SadarPuli, DSP Chowk, University Chowk, Modal Town C Chowk, Old Gala Mandi Chowk, Niaziada Chowk, Multan Ada, Radio Station Chowk, Fraid Gate Chowk, Library Chowk, Fawara Chowks, Millad Chowk, Saraiki Chowk, Welcome Chowk, Station Chowk, Dubai Chowk, Islamia Colony Chowk. The temporal data were collected three times a day morning, afternoon, evening from Sunday to Wednesday, 19 Oct 2013 to 23 Oct 2013. Timings were 7am to 9am morning, 12 to 2pm afternoon, and 5pm to 7pm at evening. The readings were taken from center of the each Chowk. The random sampling technique is used to fill the questionnaires from the respondents of selected chowks. Hundred structured questionnaires were filled from the study area. After the data collection, noise dB data and questionnaires data were tabulate in SPSS software and measure the correlation, chi-square, mean dB, standard deviation minimum and maximum dB of noise level of each time, morning, afternoon, evening with tables and graphs and data were comparing with standard. All selected locations positioned through GPS in order to register maps. GIS techniques were used; first step is Geo referencing and digitization of the map of study area. Locate and label the GPS points of selected chowks of Bahawalpur City. Noise level data were added in the attribute tables, created a data base and applied spatial temporal analysis techniques of GIS such as Interpolation, kriging, Charts and represented in Arc GIS 10.

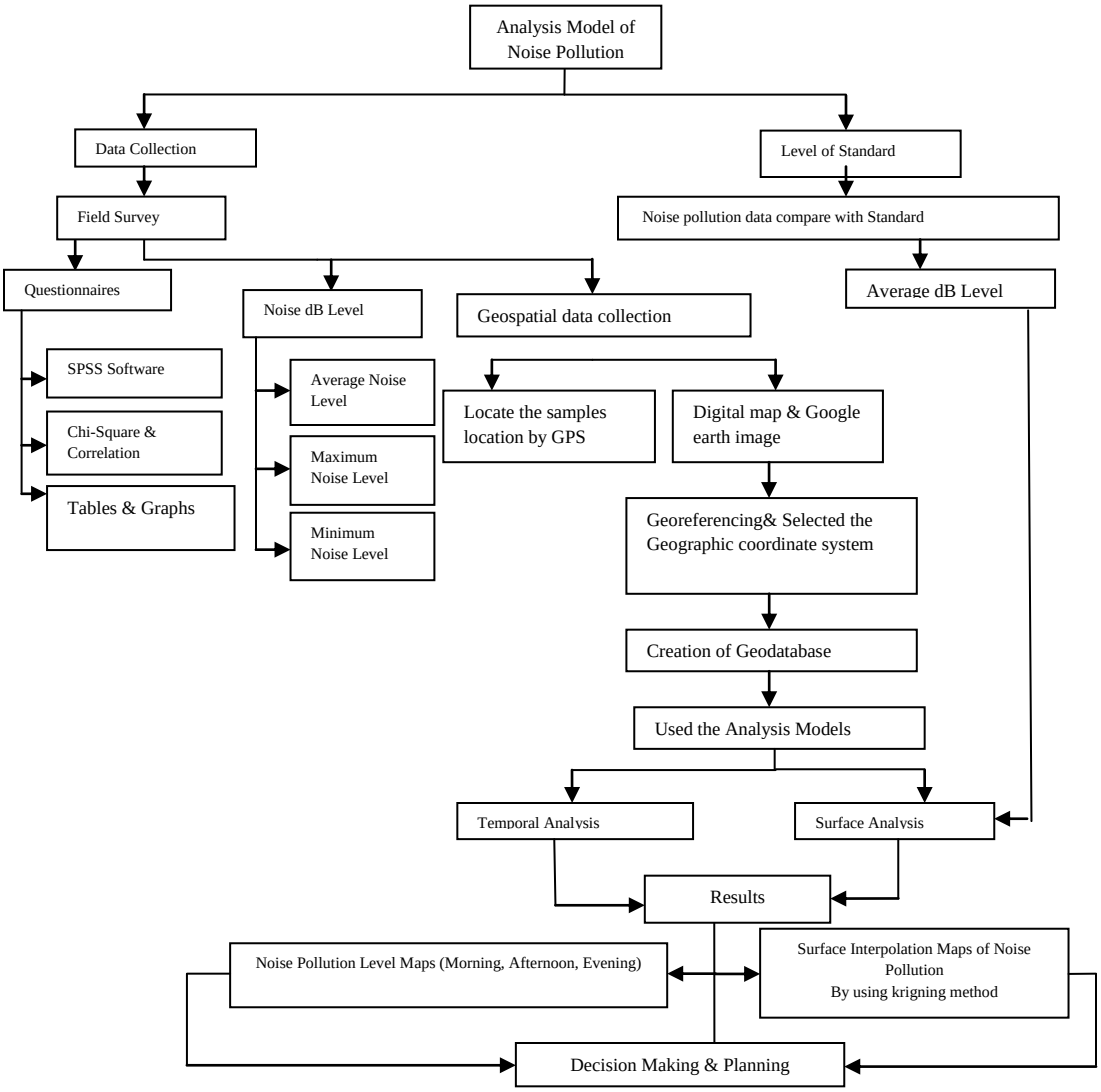

Fig. 1 Conceptual Structure of Analysis model

3. RESULTS AND DISCUSSION

The result shows that high noise level in study area. The mean and standard deviation of each sample points were measured in different time period (morning, afternoon, evening) and showed below in **(Table 2)**.

Table 2 Noise Level in Different Points of Bahawalpur City

Mean Noise Level with SD									
Selected Points	Morning			After Noon			Evening		
CHOWK 12/BC	79.60	±	0.57	86.90	±	2.78	84.60	±	0.90
MILLA WALI GALI	84.70	±	2.45	89.25	±	4.70	95.00	±	8.60
HAMAITIA CHOWK	90.45	±	5.73	100.93	±	9.55	99.48	±	8.33
GOVT. TECHNICAL COLLAGE	83.58	±	10.06	88.68	±	2.77	89.75	±	3.31
ONE UNIT CHOWK	96.25	±	1.71	94.28	±	4.72	86.85	±	3.37
SADAR PULLI	82.73	±	5.88	87.93	±	4.24	94.88	±	4.90
DSP CHOWK	83.33	±	2.73	90.15	±	5.24	90.90	±	6.89
UNIVERSITY CHOWK	82.78	±	5.65	86.63	±	2.67	89.13	±	2.50
MODEL TOWN C CHOWK	97.18	±	2.25	95.35	±	6.78	98.15	±	3.10
OLD GALA MANDI CHOWK	94.90	±	4.39	98.58	±	3.81	97.45	±	2.91
NIAZI ADA	99.73	±	10.95	99.75	±	11.97	102.23	±	10.18
MULTAN ADA	94.85	±	6.44	108.48	±	6.49	103.73	±	4.71
RADIO STANION CHOWK	84.18	±	3.37	98.30	±	1.09	89.80	±	3.93
FRAID GATE CHOWK	88.25	±	0.58	95.70	±	4.71	93.90	±	5.00
LAIBRARY CHOWK	83.35	±	1.84	87.05	±	2.67	90.65	±	4.47
FAWARA CHOWK	80.70	±	1.17	84.95	±	2.30	87.20	±	3.03
MILLAD CHOWK	92.85	±	4.89	98.53	±	2.14	92.60	±	6.81
SARAIKI CHOWK	84.13	±	4.67	88.73	±	4.33	87.75	±	4.28
WELCOM CHOWK	84.18	±	1.04	85.63	±	3.61	86.68	±	4.23
STATION CHOWK	85.63	±	3.04	91.55	±	7.26	87.43	±	1.91
DUBAI CHOWK	84.38	±	5.23	87.28	±	1.95	82.43	±	2.75
ISLAMI COLONY CHOWK	82.53	±	2.10	86.18	±	3.04	84.65	±	2.35
Total Mean	87.28			92.31			91.60		
Minimum mean	79.60			84.95			82.43		
Maximum mean	99.73			108.48			103.73		

The **(Table.2)** shows the mean level of each sample points in different time period (morning, afternoon, evening). The maximum mean noise level in morning time of niaziada chowk is 99.73. The maximum mean noise level in afternoon is of Multan ada chowk which is 108.48 and the maximum mean noise level in evening time of Multan ada Chowk is 103.73. This noise level is too much extensive among the standard.

The **(Table 3)** shows the noise level contrast of the study area with standards. The standard of the urban commercial areas in day time is 65dB but in study area noise level of morning time is 87.28dB and in afternoon it reached at 92.31dB. In evening time the standard of urban commercial areas is 55dB but in study area 91.6 dB. The noise level is high in study area that creates the health risks and social problems.

Measurement of minimum and maximum noise level at morning time of selected sample points. The overall maximum noise level in morning time is 106.8 dB and overall minimum noise level of the study area at morning time is 68.7dB. Both are go beyond with standard. Measurement of minimum and maximum noise level at morning time of selected sample points. The overall maximum noise level in morning time is 115.4 dB and overall minimum noise level study area at morning time is 81 dB. This noise level is creates the selected sample points. The overall maximum noise level in morning time is 110.2 dB and overall minimum noise level study area at morning time is 80 dB. This noise level is causing the health risk in the study area **(Table-4)**

Table 3 Noise level compare with standard

Level Compare with Standard		
	Standard (dB)	Mean Value (dB)
Morning	65	87.28
Afternoon	65	92.31
Evening	55	91.6

Table 4 Measurement of Min & Max Noise Level at Morning Time

Measurement of Min & Max Noise Level at Morning Time		
Selected Points	Minimum	Maximum
CHOWK 12/BC	78.8	80.1
MILLA WALI GALI	88.1	93.9
HAMAITIA CHOWK	76.6	90
GOVT. TECHNICAL COLLAGE	68.7	90
ONE UNIT	94	98
SADAR PULLI	75.1	89
DSP CHOWK	80.8	87.1
UNIVERSITY CHOWK	74.5	87
MODEL TOWN C CHOWK	93.9	99
OLD GALA MANDI CHOWK	88.4	98
NIAZI ADA	83.4	106.8
MULTAN ADA	85.4	99.1
RADIO STATION CHOWK	79.3	87
FRAID GATE CHOWK	87.8	89.1
LAIBRARY CHOWK	81.1	85
FAWARA CHOWK	79.5	82.1
MILLAD CHOWK	88.7	98.8
SARAIKI CHOWK	78.2	88.2
WELCOM CHOWK	83	85.1
STATION CHOWK	81.6	88.7
DUBAI CHOWK	78.9	89
ISLAMI COLONY CHOWK	79.5	84
Measurement of Min & Max Noise Level at Afternoon Time	68.7	106.8
Selected Points	Minimum	Maximum
CHOWK 12/BC	83.4	89.9
MILLA WALI GALI	82.5	93.3
HAMAITIA CHOWK	87.7	110.1
GOVT. TECHNICAL COLLAGE	85.5	92.1
ONE UNIT	88.6	99.2
SADAR PULLI	84.1	93.3
DSP CHOWK	84.9	95.6
UNIVERSITY CHOWK	83.6	90
MODEL TOWN C CHOWK	85.6	100.1
OLD GALA MANDI CHOWK	93.3	102.3
NIAZI ADA	85	110.5
MULTAN ADA	101	115.4
RADIO STATION CHOWK	97.4	99.8
FRAID GATE CHOWK	88.9	99.7
LAIBRARY CHOWK	83.8	90
FAWARA CHOWK	81.8	87.2
MILLAD CHOWK	96.6	101.2
SARAIKI CHOWK	83.7	93
WELCOM CHOWK	81	89
STATION CHOWK	81	97.4
DUBAI CHOWK	85.5	89.2
ISLAMI COLONY CHOWK	81.9	88.9
Measurement of Min & Max Noise Level at Evening Time	81	115.4
Selected Points	Minimum	Maximum
CHOWK 12/BC	83.7	85.8
MILLA WALI GALI	82.3	100.7
HAMAITIA CHOWK	88	106.2
GOVT. TECHNICAL COLLAGE	87.2	94.3
ONE UNIT	82.8	90.8
SADAR PULLI	88.4	99.4
DSP CHOWK	81.6	97.4
UNIVERSITY CHOWK	86.4	92.4
MODEL TOWN C CHOWK	94.8	101.3
OLD GALA MANDI CHOWK	94.5	100.8
NIAZI ADA	87.3	110.2
MULTAN ADA	98.4	108
RADIO STATION CHOWK	85.7	95
FRAID GATE CHOWK	86.5	97.4
LAIBRARY CHOWK	84.5	94.3
FAWARA CHOWK	83.1	90.2
MILLAD CHOWK	82.8	98.5
SARAIKI CHOWK	82.3	92.1
WELCOM CHOWK	80.8	90.7
STATION CHOWK	85.4	90
DUBAI CHOWK	80	85.1
ISLAMI COLONY CHOWK	82	87.5
OVER ALL MIN & MAX	80	110.2

Table 5 Summary of chi square result of noise pollution create hipernes and haddock

Cross tabulation	x^2	A
Chi square	54.565º	.000

N=100 (x^2) chi square value (a) level of significant statistically significant at 5%

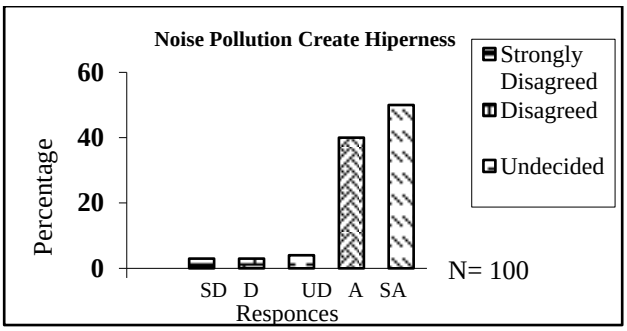

Fig. 2 Noise Pollution Create Hiperness in Bahawalpur City

The **(Fig.2)** shows that percentage of effected peoples by the noise pollution. 50% residents were strongly agree that noise pollution created hypernessand affect the human behaviors. 40% peoples were agreeing that noise pollution created hyperness. 4% peoples have undecided they have no awareness. 3% peoples were disagreeing and strongly disagree with noise pollution causedhyperness and affected the human behaviors.

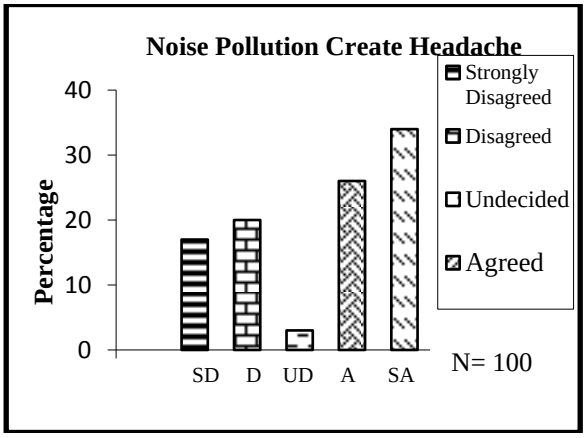

Fig. 3 Noise Pollution Create Haddock in Bahawalpur City
Source: Author, 2013

(Fig. 3) shows that 34% peoples were strongly agree that noise pollution created headache. 26% peoples were agreeing that noise pollution created headache. 3% peoples were undecided they did not know. 20% were disagreed and 17% were strongly disagreed that noise pollution did not created headache. They did not feel any kind of headache. In below table

shows the Alfa value and chi-square result between noise pollution createdhyperness and headachein study area. The result shows the significant relationships between them.

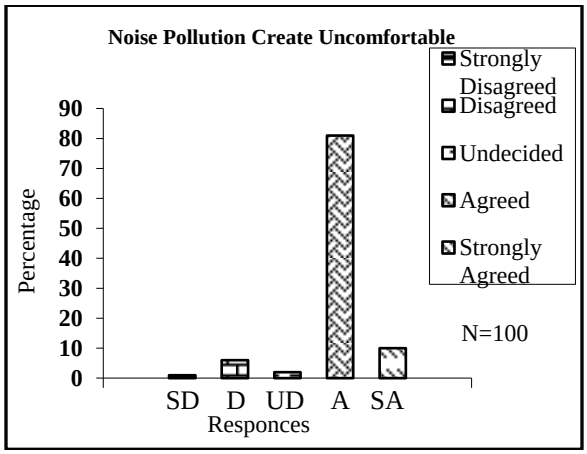

Fig. 4 Noise Pollution Create uncomfortable in Bahawalpur City

The **(Fig 4)** showsthat 10% peoples were strongly agreed and 81% peoples were agreeing that noise Pollution making residents uncomfortable in study area Bahawalpur City. 2% peoples were undecided. 6% disagreed and 1% respondents are strongly disagreed that noise Pollution did not Cause uncomfortable environment.

Table 6 Summary of chi square result of noise pollution create Uncomfortable and Disturbance during the Work

Cross tabulation	x^2	A
Chi square	39.313º	.001

N=100

(x^2) chi square value (a) level of significant statistically significant at 5%

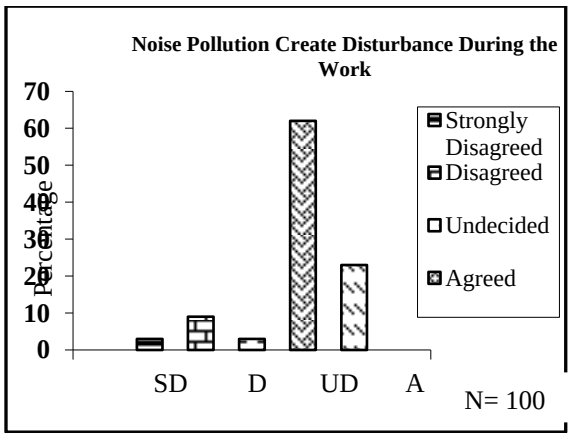

Fig. 5 Noise Pollution Create disturbance during work in Bahawalpur City

(Fig 5-10) shows that 62% peoples were agreed and 23% peoples were strongly agreed that noise pollution produced disturbance during work. 3% peoples were undecided. 9% disagreed and 3% strongly disagreed with the noise pollution disturbance during work. In below table shows the Alfa value and chi-square result between noise pollution caused the uncomfortably and disturbance during workin study area. The result shows significant relationship strong relationships between them.

Fig. 6 Digitized map of the Study area

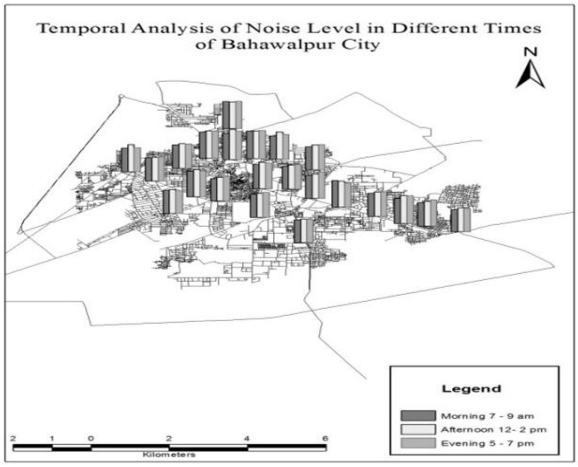

Fig. 7 Temporal analysis of noise level in different times of Bahawalpur City

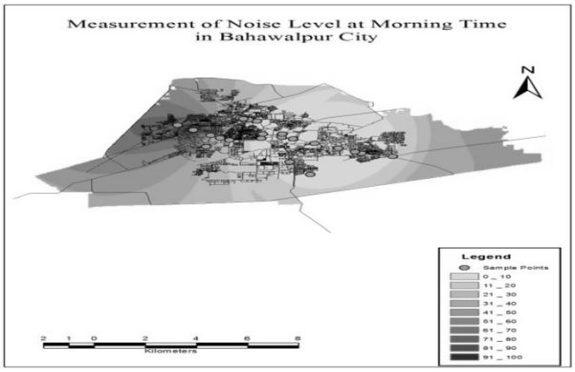

Fig. 8 Measurement of noise level at morning time in Bahawalpur City

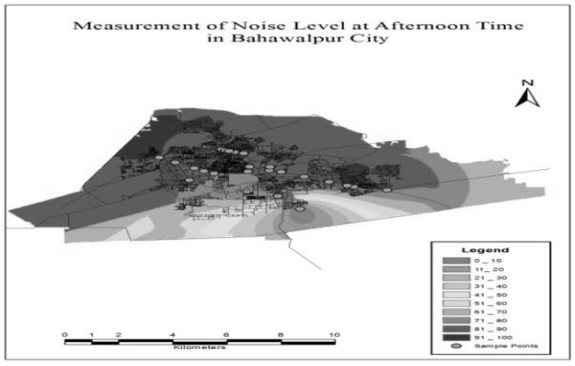

Fig. 9 Measurement of noise level at Afternoon time in Bahawalpur City

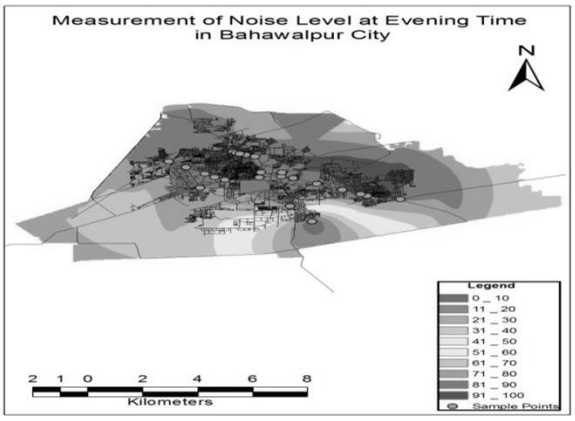

Fig.10 Measurement of noise level at evening time in Bahawalpur City

4. CONCLUSION AND RECOMMENDATION

This study reveals that the noise level in selected study areas is very high. The conclusion were obtained that the minimum mean noise level 79.60 dB in morning time and maximum mean noise level 99.73 dB in morning time of the study area. The minimum mean noise level is 84.95dB in afternoon time and maximum mean noise level 108.48 dB in afternoon time of the study area. The minimum mean noise level is 82.43dB in evening time and maximum mean noise level 103.73dB in evening time of the study area. Standard noise level is 65 dB of day time but in study area 87.28 dB in morning and 92.31 dB in afternoon time. Standard noise level is 55dB of evening time but in study area91.6 dB in evening time. This study shows that the level of noise is high in contrast to standard in the study area. Thus, it issuggested that the proper noise control measures must be adopted in urban areas. Increase the green space in urban areas, decrease the use of motor cars, reduce the use of horns, and distribution of commercial and residential areas should be properly planed by the government. The government should launch a media campaign to raise awareness to control the noise pollution. This study is helpful for urban planning and decision making in protection departments.

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