

SPATIAL PATTERNS OF NOISE POLLUTION IN FAISALABAD CITY

MUHAMMAD ARIF SAEED* AND DR. KASHIF MAHMOOD**

* M.Phil. Scholar, Department of Geography, Government College University
Faisalabad, Pakistan

** Assistant Professor, Department of Geography, Government College
University Faisalabad, Pakistan

Corresponding author Email: kashif.mahmood@gcuf.edu.pk

ABSTRACT

The present study depicts the spatial patterns of noise pollution in Faisalabad city, Punjab, Pakistan. This research is based on the primary data. We selected 105 sites from seven different land uses- road, bus station, hospitals, and residential, educational and industrial sites in Faisalabad city by using stratified sampling technique. We measured noise level in 105 selected sites. We utilized Spatial Interpolation technique- Inverse distance weighted (IDW) method to see the spatial dimensions of noise pollution in the city. We observed that the overall condition of acoustic environment is worse in Faisalabad. Results revealed that maximum noise pollution level 82 to 100dB estimated in evening time whereas noise pollution level reached up to 79 to 93 dB measured in afternoon and 71 to 86 dB recorded in morning hours. We observed that Central Business District (CBD) faced high noise pollution level.

KEYWORDS: Noise Pollution, CBD, Spatial Patterns, Faisalabad city

INTRODUCTION

Cities have always been the primary sources of noise pollution. There are different types of human activities and functions taking place in urban centers and have high population density. With the passage of time, the expansion and introduction of new urban functions and continuous population growth generated new source of noise and increased the level of noise (Garrioch, 2003, Kang and Servign, 1999, Lebedowska, 2005). High level of noise pollution is severely perilous in developing countries(WHO, 2009). Urban transition plays a significant role in increasing noise pollution in cities (Nuissl et al., 2009).Noise Pollution, being the foremost and well known nuisance factor affect the quality of life in cities throughout the globe (Akan et al., 2012, Frei et al., 2014, Hunashal and Patil, 2012). Human activities are playing a major role in spreading noise pollution in cities. Noise pollution is an unperceived worry in developing countries(Luqman et al., 2014). Noise pollution poses a serious threat to people's lives. Noise pollution associated with traffic is considered alarming factor after air pollution(Stansfeld, 2015, Stassen et al., 2008).High noise levels were recorded in developing countries and noticed that the prime cause of high noise level is increasing traffic volume (Doygun and Gurun, 2008, Jamrah et al., 2006, Onuu, 2000).

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The rate of urbanization in Pakistan has increased from 17% to 36% from 1951 to 2010 is the highest in the south Asian countries (Ghani, 2012). At present, Pakistan is facing fast urbanization and high population growth rate as 2.4% (GOP, 2018). The expected population is 242 million by 2030 and half of the population will be the part of urban centers (GOP, 2016-2017). Faisalabad is not only the industrial hub of Pakistan but also the third largest city according to population size (GOP, 2015). Its population is growing at an increasing rate with every passing day. Population growth and rapid urbanization have consequently become a prime reason for increasing number of vehicles such as buses, trucks, cars, auto rickshaws, motor bikes and industrial activities (De Coensel et al., 2005, Raimbault and Dubois, 2005). Road traffic and industrial noise pollution disturb the social, economic and physical life (Nitschke et al., 2014). There is no doubt that innovations in the field of technology enhanced the living standard of human beings, but at the same time they have generated some problems, particularly the degradation of environment.

OBJECTIVE OF THE STUDY

- 1) To explore the spatial Patterns of Noise Pollution in Faisalabad

METHODOLOGY

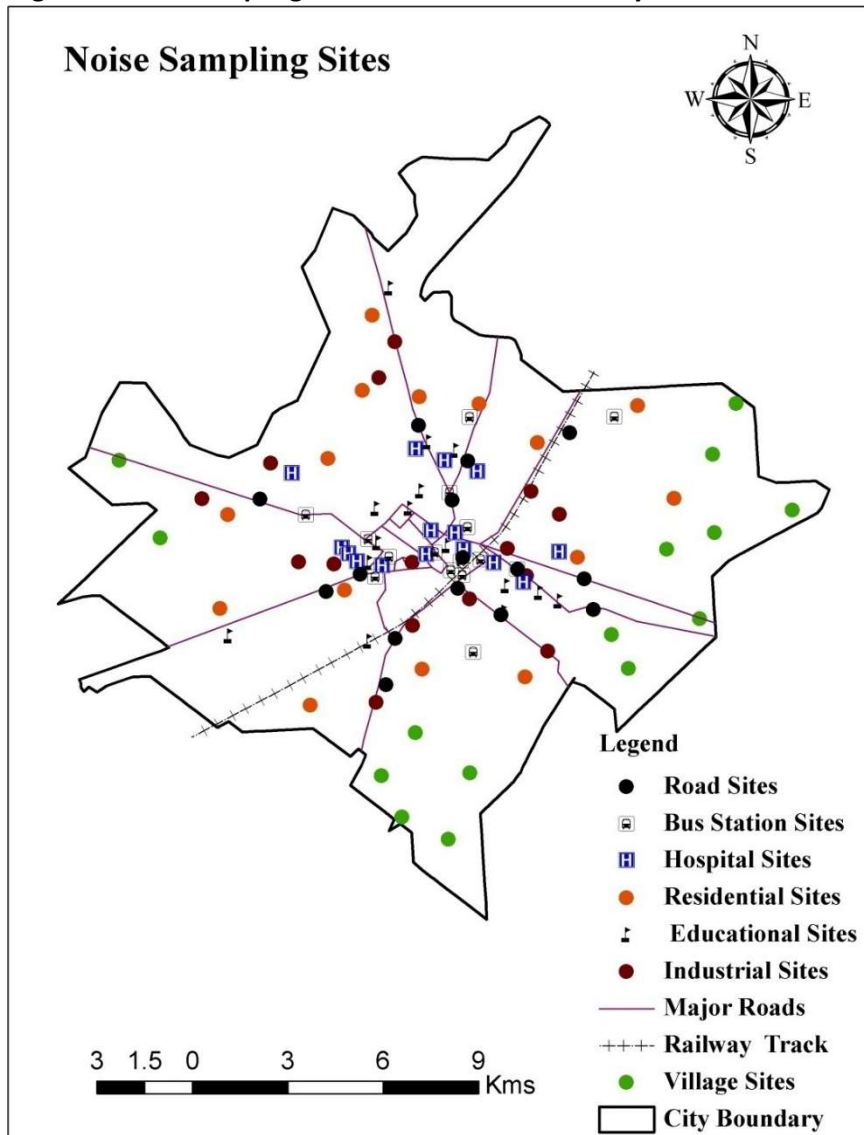
The ability to measure noise levels and display these surfaces on a map are helpful in controlling the noise pollution. The advanced modern interpolation techniques in GIS (Geographic Information System) provide an attractive and appropriate platform for its mitigation. It is now possible to obtain an accurate picture of the acoustic situation and Noise Risk Zones (NRZ) based on a finite number of sample points recorded using noise level meters. Spatial Interpolation techniques provides a clear picture of acoustic environment to show the noise risk zones (Jaaly-Sankari et al., 2010). Noise maps are important for valuation and to display the spatial distribution of noise in built-up zones (Probst and Huber, 2007).

Figure 1 shows location of study area Faisalabad city. It is situated between 30°42' and 31°47' North Latitudes and 72°40' and 73°40' East Longitudes. Faisalabad is 605 feet elevated from sea level. The total area occupied by Faisalabad district is 5856 Square Kilometers. Faisalabad city was established in 1904 having the areas of 5.8 Square kilometers at that time, now it has reached up to 213 square kilometers (GOP, 2015).

We designed a Survey to study patterns of noise pollution. This survey was carried out from June 2016 to July 2016 to collect the noise samples. Sample size was 105 different sites selected through stratified sampling techniques. Seven different sites - major roads, Bus station, educational institutes, Hospital, residential, industrial and from rural sites were

considered. Fifteen noise samples were collected from each site. We used Sound Level Meter to measure noise level. The sound level meter was kept 1.2 meter above from ground level and 10 to 15 feet away from roads side. All the noise sample points were coordinated through GPS (Global Positioning system). Noise samples were taken at the peak hours of the day like 6.00 am - 8.00 am (Morning) 12 pm – 2.00 pm (Afternoon) 3.00 pm-5.00 pm (Evening). We utilized Spatial Interpolation technique (Kriging) by using ArcGIS-10 to estimate spatial exposure of noise pollution in Faisalabad city.

Figure 1.Noise Sampling Locations of Faisalabad City



Spatial Patterns of Noise Pollution in Faisalabad City.

Source: Field Survey conducted from June 2016 to July 2016 in Faisalabad city

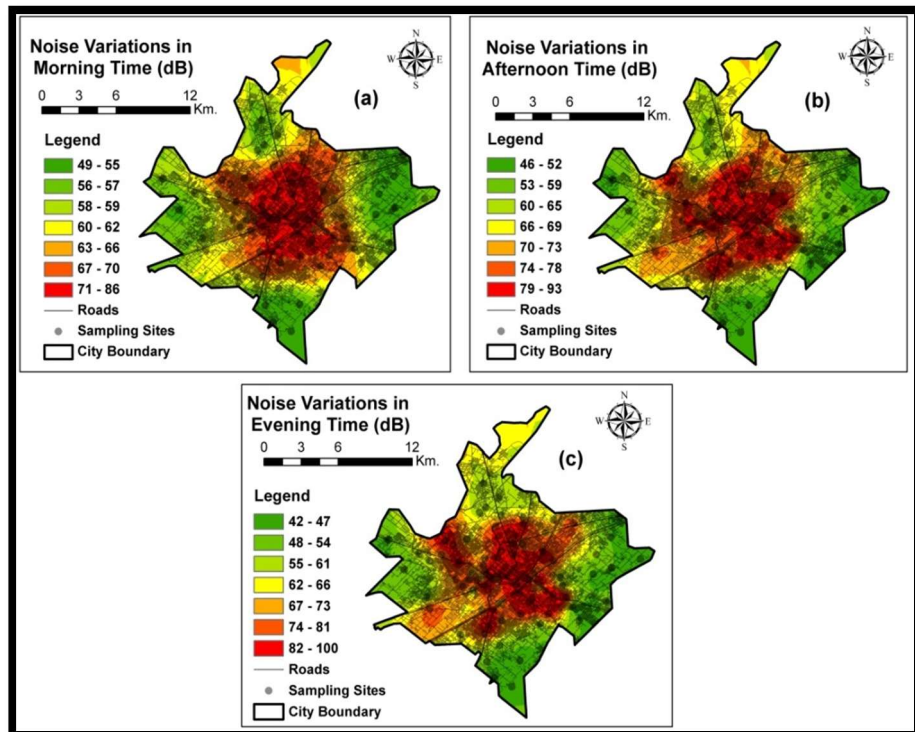
RESULTS AND DISCUSSIONS

Figure 2 shows patterns of noise pollution in Faisalabad city. The inset map (a) shows the noise level in morning time. Central area of the city is highly polluted with noise. The reason for this high concentration is traffic congestion and, industrial and commercial activities. According to the World health organization (WHO) 50 dB noise levels create moderate annoyance and 55 dB generates serious annoyance (Mehdi et al., 2011). The Maximum and minimum level of recorded/observed noise pollution is 49 dB shown on the map as green strip. However, disturbances in sleep quality could arise with average outdoor noise level reaching 40 dB (WHO, 2009). As it can be seen in map (a) that the outer zone of the city area least affected by the noise pollution (49 to 55 dB) and it does not have much adverse effects on human health. The minimum, maximum and moderate values of noise pollution are shown in each map with the help of legend.

The inset map (a) depicts the level of noise pollution of in afternoon time. Noise level increases to 93 dB and it is seven times more than the recorded noise level in Morning time. According to the Environment Protection Department Punjab, the legal limit of noise levels 55 dB at residential zones and in commercial areas should not be exceed than 65 dB (GOP, 2019). Some sites on the Western side of the city also portray high noise pollution which is shown with red spots. Noise level is decreased on the South Eastern side of the city that is presented in green color as compared to Morning time noise levels which is depicted in yellow color. The map (c) clarifies the noise levels at Evening time in Faisalabad city. Spatial pattern of noise pollution is squeezed in map (c) as compared to Morning and Afternoon times noise levels because in Evening, different institutions and activities are dismissed. Maximum noise level 100 dB is recorded in Evening time which is higher as compared to Morning time 86 dB and Evening time 93 dB noise level. It means that noise level 93 dB in Afternoon times exceeded 100 dB in Evening times. Hussain et al. (2014) measured the noise levels at three different sites of Faisalabad city and concluded that the three sites are severely polluted and the average sound level is greater than 85 dB. Minimum noise level of 42 dB recorded is very low as compared to Morning and Afternoon times. The inner most part of the city is vulnerable for the hearing capacity/sense of the inhabitants.

Noise Pollution major cluster is found at CBD (Central Business District) in the morning time. We think that it is just because of the movement of the

daily commuters from suburban areas toward center of the city. The spatial variation of acoustic environment is somehow different in afternoon as compared to morning. Noise condition in evening time is quite different from morning and evening time there is dispersed variations found in evening time, because in the evening time people move from their homes. The pattern of noise is different in all three times of the



day, just because of the different urban activities in different times of the day.

Figure 2. Spatial Patterns of Noise Levels in Faisalabad City

Source: Field Survey conducted from June 2016 to July 2016 in Faisalabad city

The maximum and minimum noise levels of Evening time were found 102.66 dB recorded at Jaranwala road near station Chock and 42 dB in Chak 215 Rb. While, the noise situation on bus/van stations, noise level 101.66 dB recorded at Larri Adda, The situation is getting worse as noise pollution is constantly increasing, morning and evening time noise levels were recorded high in Karachi, Pakistan(Mehdi et al., 2011). Minimum 67.66 dB recorded at Nadir Flying Coach station. The highest noise level 101 dB recorded in silence zone of Civil Hospital and the lowest 47.33 dB recorded at Makki Hospital. The noise condition in residential area is also

Spatial Patterns of Noise Pollution in Faisalabad City.

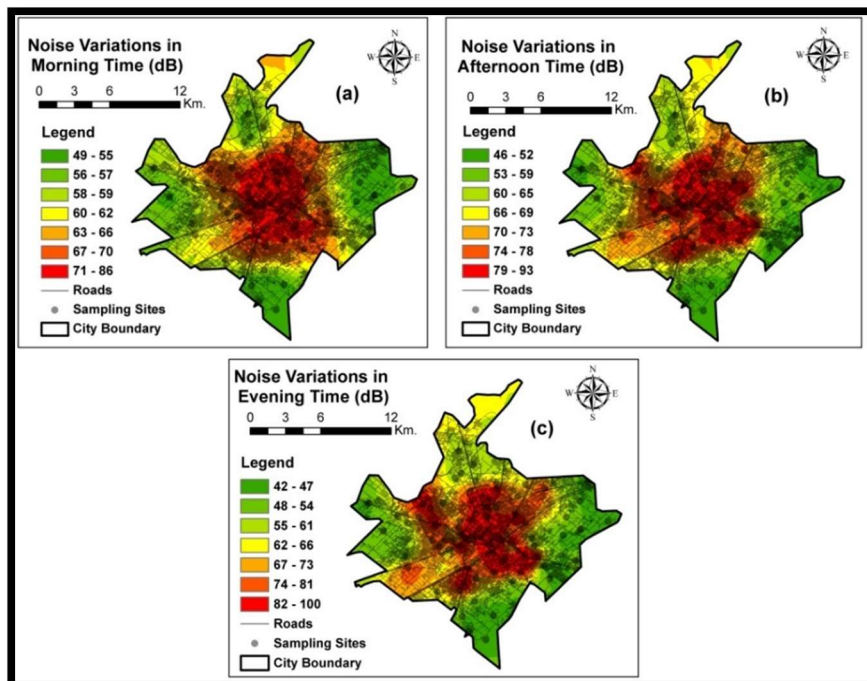
found polluted, 78.33 dB noise level recorded at the area of Allama Iqbal colony and 48.33 dB noise level recorded in Ameen Town. Educational institutions were also under this hazardous problem, the maximum noise level 94 dB recorded at the site of Punjab medical College Jaranwala road and 55.33 dB found in Government College University Faisalabad. The maximum noise level 97 dB is recorded in Qadir Looms and 52.66 dB is recorded in a Chemical industry. All the other variations of noise pollution at three times are depicted by the spatial Kriging maps with maximum, minimum and average noise levels. This worst condition of Noise pollution disrupted the quality of life in the city particularly; it has negative impacts on noise sensitive sites like Hospitals, Educational Sites etc.

Table. 1 Noise levels environmental standards Govt. of Punjab, Pakistan

	Noise limits in dB forceful from 1st July, 2013	
Area/Zone	Day time Noise dB	Night time Noise dB
Residential	55	45
Commercial	65	55
Industrial	75	65
Silence	50	45

(GOP, 2019)

Table 1 displays the noise pollution levels environmental standards of different sites (residential, commercial, industrial and silence) day and night times set by the Government of Punjab, Pakistan last from 1st July, 2013. Environmental noise pollution limits at various sites as residential 55 dB, commercial 65 dB, industrial 75 dB and silence zone 50 dB at day time



while at night time noise level limits set as minimum as residential zone 45 dB, commercial 55 dB, industrial 65 dB and silence zone 45 dB. We observed that mostly sites have exceeded noise levels as compared to those set by the Government of the Punjab, Pakistan.

CONCLUSION

Noise pollution has many adverse effects on people health. Acoustic conditions of the city are critical and problematic with its increasing level of noise pollution from their legal limits as prescribed by the Government of Punjab, Pakistan and disrupt the quality of life. It has been found that the spatial variability of noise pollution is higher in Morning time. We also recorded the noise pollution data from site to site which shows the results as maximum 101.33 dB (Morning time) at station chock and minimum 58.33 dB (Morning time) along Ghulam Muhammad road site were recorded. At bus/van station sites Maximum noise level 101.66 dB (Evening time) at Larri Adda and minimum 70.66 dB (Morning time) at Maddan Pura bus/van station were measured While, the noise situation at hospital sites maximum noise level 101 dB (Evening time) and minimum 47.33 dB (Morning time) were recorded. Residential areas as Allama Iqbal colony has maximum noise level 78.33 dB (Afternoon time) and minimum 48.33 dB (Evening time) recorded on the site of Ameen town. Sites along educational institutions have maximum noise level 90 dB (Afternoon time) at independent medical college site and minimum 60.66 dB (Morning time) at University of Faisalabad site. Faisalabad city has a variety of textile industries which also paly crucial role in the increment of noise pollution as maximum 97 dB (Evening time) at Qadir Looms and minimum 52.66 dB at the site of chemical industries. We also collected some noise samples rural adjunct areas along the city which have maximum 59.66 dB (Morning time) at Chak 208 R.B and minimum 42 dB (Evening time) recorded at 215 R.B. The unplanned and illegal busses/Van stands may also a cause of noise pollution in the city. The proper urban planning can reduce the noise pollution level of the city. The active participation of public regarding this grievous problem may also reduce the noise pollution from the city. Further the impacts of noise pollution on the residents would be also examined. It is recommended that People working in heavy industrial segments should use aids like noise helmets, ear plugs, ear muffs and headphones from the harmful effects of noise pollution. Remove the noisy engines and designing fabricating and quieter machines. Silencers should be used to control the automobiles, ducts, exhausts etc. There should be a distance between noise sources and residential areas. There should be silence zones near hospital, educational institutes etc. Industries, bus terminals, railway stations should be away from the residential areas.

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Appendix I Noise Pollution Levels at different sites of Faisalabad

No.	Locations	Morning	Afternoon	Evening	Averages
1	Station Chock Road	101.33	87.33	100	96.2
2	Jaranwala Road Near Station Chock	86	102.66	93.33	94.0
3	Jaranwala Road Baba Fareed Chock	83.66	92	89.33	88.3
4	Samundri Road	79.66	82.66	96.66	86.3
5	Samundri Road near D-Type	93.33	98.66	99.33	97.1
6	Allama Iqbal Colony Road	74.66	80	88.33	81.0
7	Satayana Road	79.66	100	99	92.9
8	Jhang Road	67.66	80	79	75.6
9	Sargodha Road	70.33	73.66	84.66	76.2
10	Millat Road	84.33	73.66	85	81.0
11	Lahore Seikhupura Faisalabad Road	59	72.66	77.66	69.8
12	Sangla Hill Road	69.33	76.66	65.33	70.4
13	Narwala Road	85	92	82.66	86.6
14	Airport Road	64.66	68.66	58.33	63.9
15	Ghulam Muhammadabad Road	58.33	65.63	73	65.7
16	G.T.S	75.66	77.33	86	79.7
17	Nadir Flying Coach	67.66	71.66	78.66	72.7
18	Khawja Travel	79	87	94.33	86.8
19	Railway station	74.66	84	100	86.2
20	Muhammidi chock Van Stand	69.66	79.33	82.66	77.2
21	Saddique bro bus stand	67.66	72.66	78.33	72.9
22	Maddan Pura Bus, Van Stand	70.66	84.33	89.66	81.6
23	Narhwala Bus, Van stand	96.66	96	92.66	95.1
24	Speed star Travels	68.66	76.66	85.33	76.9
25	Allied Mor Bus, Van Stand	86	94.33	97.33	92.6
26	Usman Town bus Stand/Stop	71.66	76.66	88.66	79.0
27	New subhan bus Stand	88	88	100	92.0
28	koehstan bus station	78.33	85.33	95	86.2
29	Millat chock bus Stand/Stop	77.33	88.66	84	83.3
30	Larri Adda	95.66	100.66	101.66	99.3
31	General Hospital GM Abad	67	69.66	83.33	73.3
32	Allied Hospital	82.33	85	90.33	85.9
33	Sahil Hospital	78.33	80.33	79	79.2
34	Aziz Fatima Hospital	74.33	73.66	73.66	73.9
35	Mian Muhammad Trust Hospital	76	84.66	85.33	82.0
36	Faisalabad Institute of Cardiology	93	95.66	96.66	95.1
37	TB Hospital	67.66	78	93	79.6
38	Civil Hospital	98	100	101	99.7
39	Faisal Hospital	67	74.33	83	74.8
40	Al Noor Hospital	70	75.33	79	74.8
41	Yasin Memorial	61.33	67.33	64.66	64.4
42	National Hospital	65.66	70	71.33	69.0
43	Chiniot Hospital	79.66	81	79.33	80.0
44	Makki Hospital	47.33	55	64	55.4
45	Mujahid Hospital	53	63.33	68	61.4
46	Garden Town	52.66	63.66	59.66	58.7
47	Ameen Town	50	63	48.33	53.8

48	Partab Nagar	53	57.33	60.66	57.0
49	Muzaffar Colony	52	67	62.33	60.4
50	Allama Iqbal Colony	67	78.33	69.66	71.7
51	Rabbani Colony	57.33	60.66	54.33	57.4
52	Masoodabad	52.33	58	55.33	55.2
53	Eden Valley	49.66	55.33	56	53.7
54	Yousafabad	49	54.66	58.66	54.1
55	Nishat Abad	61.66	62.66	69	64.4
56	Green Town	61.66	74	64.33	66.7
57	Shadman Town	48.66	56.66	59.33	54.9
58	Gahfoor Town	49.66	55.66	57.66	54.3
59	Islamic City	50.33	55.66	57.33	54.4
60	Ejaz Town	59.33	63	64.33	62.2
61	Agriculture University Faisalabad	87.33	85	70	80.8
62	Divisional Public School	83.66	90.33	80.33	84.8
63	Faisalabad Education University	65.66	72.66	67	68.4
64	Faisalabad Institute of T&F and Design	75.66	83.66	86.33	81.9
65	G.C College university Faisalabad	55.33	70.66	62	62.7
66	Independent Medical College	82.66	90	87.33	86.7
67	Biotechnology and Genetic Engineering	71	78.33	80.33	76.6
68	G.Post Graduate College of Commerce	72.33	85.33	83.66	80.4
69	Institute of Modern Languages	65	73	78.33	72.1
70	Punjab College of Science	77	87	93.66	85.9
71	Punjab Medical College	83.33	90.33	94	89.2
72	The City College of Commerce	79.66	83.66	90.33	84.6
73	The Summit College	64.33	78.66	80.66	74.6
74	University of Faisalabad	60.66	65.33	61	62.3
75	Virtual University	72.33	86.33	92	83.6
76	Sharif Textile industries	76.66	85.66	88	83.4
77	Sitara Chemical Industries	58	72	81.33	70.4
78	Mushtaq Textile Printing Industries	59	78	70.66	69.2
79	Ayub Textile Industries	79.66	89.33	81.33	83.4
80	Textile Dyeing Industries	56.66	78	84	72.9
81	Rashid textiles industry	60.33	71.66	59	63.7
82	Chemical Industries	52.66	59.66	60	57.4
83	New shahid Chemical Industries	65.66	69.66	76	70.4
84	Qadir Looms	85	94.66	97	92.2
85	Alkaram Chemical Industry	59	67	59.33	61.8
86	Lyallpur Marbel Industry	58.33	77	72.66	69.3
87	Shehzad Solar sub pumps Industry	55.33	91.66	80.33	75.8
88	Five star textile Industry	58.66	83.33	79.33	73.8
89	Mashallah Zari industry	61.66	70.33	65	65.7
90	Pepsi cola Factory	63.33	73.33	79	71.9
91	Chak No. 235 RB Niamuana	46	46.33	43	45.1
92	Chenab Nagar	45	52.33	46.66	48.0
93	Shibanagar	46.66	51	48	48.6
94	Ahmad Nagar	52	46.66	43.33	47.3
95	Sandhu Town	50	51.66	50	50.6
96	215 Rb Nethari	58.66	45.33	42	48.7

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97	Madina Abad	52	48.33	44.33	48.2
98	215 RB Kakuana	54.33	50.33	49.66	51.4
99	Chak No 208 RB Dogranwala	59.66	57.33	47.66	54.9
100	Lawayer Housing Society	58	47.33	43	49.4
101	Faisal Garden	48	52	43.33	47.8
102	Chak 204 RB	54	49	46.33	49.8
103	Chak No. 219 RB Talianwala	47.33	53.66	49	50.0
104	Chak No 61 JB Dharoran	56	47.33	46.66	50.0
105	Eden Garden near 208 RB	42.33	48.66	44.66	45.2