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Noise Pollution - A Case Study of Rawalpindi City, Pakistan

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Abstract. In this study, noise level was measured during day time in 88 different locations of the Rawalpindi city, Pakistan, which included roads, choaks, residential areas, educational institutions, hospitals, railway stations,airport, bus stands, shopping plazas and markets. The noise measurements were performed with a calibrated sound level meter. Study finds that overall minimum and maximum noise levels for the main roads and choaks were 55.4 and 101.9 dB(A), for residential areas 38.80 and 91.0 dB(A), for educational institutions 60.0 and 94.4 dB(A), for hospital 45.1 and 84.4 dB(A), for railway stations, airport, bus stands 59.2 and 102.5 dB(A) and for shopping plazas, markets 53.8 and 81.2 dB(A), respectively. The result of the study revealed that the noise level surpassed the prescribed NEQS limits as well as WHO guideline values for noise in specific environments in all areas under study, which can cause harmful effects on human health, animals and the environment.

Keywords: noise pollution, sound level, environment

Introduction

Noise pollution can be defined as intrusive noise that disrupts, distracts, or detracts from regular functioning. Noise pollution is not new, but it has become more problematic with the developments associated with industrialisation and urbanisation. Between 1987 and 1997, community noise levels in the United States were estimated to have increased by 11% and were predicted to continue increasing at that rate or more (Staples, 1997). The response of the human ear to sound depends both on the sound frequency (measured in Hertz, Hz) and the sound pressure, measured in decibels (dB). A normal ear in healthy young person can detect sounds with frequencies from 20 Hz to 20,000 Hz. Noise measurements are expressed by the term sound pressure level (SPL), which is logarithmic ratio of the sound pressure to a reference pressure and is expressed as a dimensionless unit of power, the decibel (dB). The reference level is 0.0002 microbars, the threshold of human hearing.

$$\text{Decibel } L_{eq} = 10 \log 10\ L/L^{\circ}$$

where:

L_{eq} = equivalent noise level; L = sound intensity; L° = reference level

Sound level becomes noise when it crosses the 70 dB mark. Noise levels above 80 decibels produce damaging effects to the ear. It can cause irreparable damage and lead to permanent hearing loss when noise level is above 100 decibels for a considerable period of time.

For measurement of noise emission a sound level meter is used. A measure of the level of sound is called the decibel. The zero of the decibel scale is the hearing threshold. Sounds at 0-10 decibel are so quiet that they are almost impossible to hear, while at the top end of the scale, at around 150 decibel, it can damage eardrums. (http://www.epa.vic.gov.au).

There are many sources of noise pollution such as different machines used in industries, horns and whistles of railway engines, switching and shunting operation in rail yards, airoplanes etc., that have significant negative impact on human health. Noise pollution is a significant environmental problem in many rapidly urbanising areas. This problem is not properly recognised despite the fact that it is steadily growing in developing countries (Murthy *et al*., 2007). Traffic noise is the biggest source of noise pollution, especially in urban areas. For example an average noise level produced by vehicular traffic on roads of Karachi city, Pakistan, is 90 dB (A) (Khan *et al*., 2010). Noise level of 112.3 dB(A) was observed in a study conducted in Tangail Municipal area, Bangladesh. Noise levels in this study area exceeded the recommended level by WHO at 34 out of 47 measuring points (Mia *et al*., 2012). Noise-induced hearing loss (NIHL) in humans is a major problem stemming from noise pollution as well as heart-related,

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respiratory, neurological and other physiological problems. Stress, high blood pressure, anger and frustration, lower resistance to disease and infection, circulatory problems, ulcers, asthma, colitis, headaches, gastrointestinal disorders, and many other physiological and psychological problems have been linked directly to noise. In addition, children have been shown to suffer from slower language development and disruption of learning as a result of noise.

A study carried out at ENT Department, Sir Ganga Ram Hospital, Lahore, found that public transport drivers are exposed to excess noise on roads in Lahore and 65% of them had noise induced hearing loss (NIHL). 25% had normal hearing threshold and 10% had disabling hearing loss (Aslam *et al*., 2008). The hearing ability of the inhabitants of Dhaka city, Bangladesh, has reduced and they are suffering from permanent deafness due to noise pollution (Alam *et al*., 2001). In developed countries, as many as four to five million people, i.e., 12-15% of all employed people, are exposed to noise levels of 85 decibels or more (WHO, 2001). More than five million children in the United States, ages six to nineteen, suffer from noise-induced hearing impairment (Havas, 2006). In the exposure to noise impaired children's reading comprehension and caused a delay in reading skills development (Clark and Stansfeld, 2005). In children in noisier neighborhoods were shown to suffer from increased stress and diminished motivation (Evans *et al*., 2001).

In the present study, noise level was estimated in Rawalpindi city, Pakistan. Rawalpindi is situated at latitude 33.60 °N and longitude 73.04 °E, in the province of Punjab. It is the fourth largest city in Pakistan after Karachi, Lahore and Faisalabad. Rawalpindi city is divided into two tehsils:

Potohar (southern Rawalpindi)
Rawal (northern Rawalpindi)

The population of Rawalpindi city is approximately 19, 91,656 (World Gazetteer, 2010). The city is home to several industries and factories. The total area of the city is approximately 108.08 square km (Wiki/World Gazetteer). Murree road and Peshawar road are main roads of the city. Murree road has been a hot spot for various political and social events. Kashmir road, Haider road, Bank road, Hospital road, Jinnah road, Said pur road, IJP road, Rawal road, Tipu road, Tench road, Misrial road, Adiala road and Airport road are other important roads of the city. Main bazaars and markets of the city are Raja bazaar,Tench bazaar, Moti bazaar, Kashmiri bazaar, Sarrafa bazaar, Saddar area, Commercial market, Westridge market, Chah Sultan market and Kamran market. Number of shopping plazas and centers have been constructed on both sides of Murree road.

Being twin city of Islamabad, the capital of Pakistan, there is a rapid expansion in Rawalpindi city area. This expansion is mostly unplanned. Most of the areas particularly to the urban side are subjected to unacceptable noise conditions due to construction, manufacturing, traffic and recreational activities. A comprehensive national survey has not been conducted to assess the level of noise pollution in big cities of Pakistan. Present study was conducted to assess the noise level in the Rawalpindi city as well as its main causes. It will certainly help implementing agencies to understand the severity of the noise pollution problem of the city and take proper remedial measures.

Materials and Methods

In this study, sound level meter type 2240, Bruel & Kjaer, Denmark was used to measure the noise level. The microphone converts sound to an equivalent electric signal, which is processed by the instrument. Processing includes applying frequency and time weightings to the signal as specified by international standards, IEC 61672-1 to which this metre conforms.

Frequency weighting adjusts how the sound level meter responds to different sound frequencies. This is necessary because the human ear's sensitivity to sound varies according to the sound's frequency. The most common frequency weighting in use is A-weighting, which adjusts a signal in a way that best resembles the human ear's response at medium-range levels. It is the weighting required for nearly all environmental and workplace noise measurements and is specified in international and national standards and guidelines. All of Type 2240's measurement parameters apply A-weighting, except for measurement of peak levels, where the C frequency weighting is applied.

Time weighting specifies, how the sound level metre reacts to changes in sound pressure. It is an exponential

averaging of the fluctuating signal, providing an easy-to-read value. Type 2240 applies the Fast, or F time weighting, which is required weighting according to the vast majority of international and national standards and guidelines. Once the signal is processed through the weighting filters, the resulting sound pressure level is displayed in decibels (dB) on the instruments display.

All the measurements were taken at different times during day time (between 10 am to 3 pm) from August to October, 2012. Noise level was noted ten times at each point then averaged through summation of all values divided by the number of observation. At the time of collecting data of noise, values of frequent peaks were measured. The minimum and maximum levels of noise were recorded in each observation on the basis of maximum and minimum peaks noted during data recording. Standard deviation was calculated from ten observations obtained from each point.

Results and Discussion

In this study noise level was measured during day time in 85 points in different areas of the Rawalpindi city, Pakistan. The minimum, maximum and average noise levels were measured in dB(A) and standard deviation of all points is shown in Tables 1-6. Minimum and maximum noise levels at monitoring areas are shown in Fig. 1.

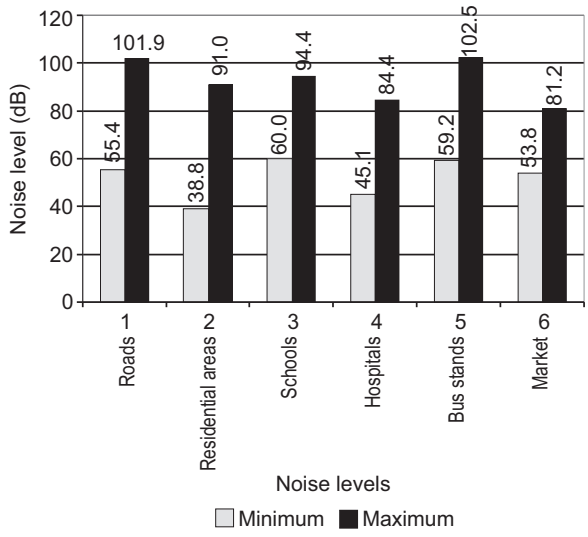

Fig. 1. Noise level (minimum and maximum).

The result of the study revealed that the noise level surpassed the prescribed NEQS (Table 7) as well as WHO guideline values (Table 8) in all areas under study, which can cause harmful effects on human health, animals and the environment. The study finds that overall minimum and maximum noise levels for main roads and choaks is 55.4 and 101.9 dB(A), with mean values 61.6±4.8-83.7±5.88 dB(A), higher than NEQS and WHO guideline value of 75(NEQS Table 7) and 70 dB (WHO guidelines,Table 8), respectively. Minimum and maximum noise level for residential areas is 38.8 and 91.0 dB(A), with mean values 47.7±5.2-78.2±4.9 dB(A). It is also on higher side as compared to NEQS and WHO limits of 55 dB (NEQS Table 7, WHO guidelines Table 8) set for outdoor living areas. At educational institutions minimum and maximum noise level is 60.0 and 94.4 dB(A), with mean values 65.7±3.7-85.0±4.3 dB(A), respectively. It is about 11-35 dB high than NEQS and WHO guideline value 50 dB(NEQS Table 7 and WHO guidelines, Table 8) set for school playground outdoor and silence zone. For hospitals minimum and maximum noise levels observed are 45.1 and 84.4 dB(A), with mean values 52.6±4.0-76.3±4.6 dB(A), which is on higher side as compared to WHO guideline values of 30 dB (WHO guidelines, Table 8) set for hospital, ward rooms, indoor as well as NEQS for silence zone, which is 50 dB(NEQS Table 7). It is an alarming sign for hospitals management. For railway stations, airport, and bus stands observed minimum and maximum noise level is 59.2 and 102.5 dB(A), with mean values 56.4±9.3-80.2±2.4 dB(A), higher than WHO as well as NEQS limits for traffic. For shopping plazas, markets minimum and maximum noise level observed is 53.8 and 81.2 dB(A), with mean values 58.8±5.2-78.7±1.5 dB(A), respectively. It is also higher than WHO guideline value of 70 dB (WHO guidelines, Table 8) set for industrial, commercial, shopping areas as well as NEQS limit of 65 dB (NEQS Table 7) set for commercial areas.

Conclusion

The results of the study revealed that the noise level surpassed the prescribed NEQS limits as well as WHO guideline values of noise level for specific environments, in all areas under study in Rawlpindi city which

Table 1. Results from noise measurements on roads and choaks

Roads and choaks	1	2	3	4	5	6	7	8	9	10	Max	Min	Mean	SD
IJP Peshawar road	69.0	76.8	75.8	70.3	71.6	68.2	88.2	74.8	75.1	80.1	88.2	68.2	75.0	6.0
IJP Toll plaza	80.5	92.3	73.7	82.1	94.2	81.9	75.8	70.0	82.5	77.9	94.2	70.0	81.1	7.6
IJP Carriage factory	81.3	80.9	72.9	86.5	89.7	78.0	82.2	83.2	80.8	70.2	89.7	70.2	80.6	5.8
IJP Pir wadhai more	80.0	89.4	76.0	84.1	101	71.2	77.1	76.0	80.0	89.0	101.0	71.2	82.4	8.8
IJP Pindora choak	84.8	75.5	78.1	89.7	98.1	82.0	69.9	74.4	81.1	90.1	98.1	69.9	82.4	8.5
Agha shahi avenue-9	72.4	70.6	75.1	72.0	76.6	78.2	69.2	66.6	78.1	71.0	78.2	66.6	73.0	3.9
Faizabad choak	70.1	69.1	66.2	69.0	71.3	68.2	82.6	70.9	75.2	68.5	82.6	66.2	71.1	4.7
6th road choak	67.7	69.0	68.1	69.1	66.0	65.1	86.9	68.9	75.6	71.6	86.9	65.1	70.8	6.4
Muslim town sadiqabad choak	70.2	66.8	68.2	75.2	65.9	78.8	80.1	70.0	65.7	80.0	80.1	65.7	72.1	5.9
Chandni choak flyover	77.7	66.4	64.0	63.3	62.8	69.4	61.9	68.9	101.9	98.2	101.9	61.9	73.5	14.8
Sirvice road dhoke kashmirian	69.3	67.8	72.2	67.4	68.4	69.9	67.0	71.9	61.9	66.8	72.2	61.9	68.3	2.9
Banni choak	72.3	71.9	68.6	68.9	69.8	76.1	73.8	74.0	72.6	70.2	76.1	68.6	71.8	2.4
Asghar maal choak	80.0	77.7	75.5	80.6	76.7	78.2	73.1	79.7	74.7	77.2	80.6	73.1	77.3	2.4
Pindora chungi choak	72.5	71.4	75.4	78.4	68.2	70.6	73.1	60.7	58.9	61.3	78.4	58.9	69.1	6.7
Siddiqui choak	77.1	74.0	68.1	69.5	69.0	71.0	72.7	70.6	69.7	68.3	77.1	68.1	71.0	2.9
Committee choak	77.5	76.5	80.0	92.5	79.5	81.1	78.3	84.1	78.8	76.1	92.5	76.1	80.4	4.8
PAF Auditorium choak chaklala base	72.1	72	66.8	65.4	72.8	76.8	69.1	63.2	59.8	78.2	78.2	59.8	69.6	5.9
RDA/WASA Liaqat bagh murree road	67.2	68.8	69.5	66.5	90.5	71.5	76.3	78.9	81.5	85.5	90.5	66.5	75.6	8.3
Moti mahal murree road	73.7	75.6	75.0	94.8	87.6	90.1	82.6	80.5	83.5	89.4	94.8	73.7	83.3	7.2
Mareer hasan choak	68.9	85.5	72.5	83.5	77.4	70.8	69.5	68.0	70.0	92.2	92.2	68.0	75.8	8.5
Kachahri choak	72.9	68.9	70.5	71.9	68.6	71.5	90.2	89.0	80.0	73.5	90.2	68.6	75.7	8.0
Ammar choak	68.3	71.5	72.2	69.8	75.5	81.6	61.8	60.7	79.9	62.4	81.6	60.7	70.4	7.3
Ayub park Main gate GT road	66.4	69.1	70.2	65.4	67.3	64.8	68.8	69.8	74.1	77.5	77.5	64.8	69.3	3.9
Chungi no.22 choak	86.4	81.6	80.9	75.6	81.4	77.5	86.9	82.6	79.4	79.0	86.9	75.6	81.1	3.6
Tench bhata dispensary road	77.6	83.5	83.9	91.8	81.1	84.1	82.2	80.5	76.8	95.6	95.6	76.8	83.7	5.9
Kalma choak Dhoke syyedan	75.0	69.7	64.4	70.4	68.7	70.3	74.4	80.1	67.3	72.2	80.1	64.4	71.3	4.4
Fawara choak raja bazaar	82.9	77.4	75.4	71.7	84.6	79.3	80.0	87.9	90.1	70.9	90.1	70.9	80.0	6.5
Dinghi khui raja bazaar	71.5	70.7	79.1	66.5	66.9	78.4	68.9	70.0	69.2	81.5	81.5	66.5	72.3	5.4
Bohar bazaar choak	83.2	80.5	74.1	79.3	74.8	75.6	81.9	80.2	78.6	88.6	88.6	74.1	79.7	4.4
F.G Boys school Peshawar road	85.2	84.4	73.6	69.1	74.4	70.4	76.0	69.7	78.4	78.8	85.2	69.1	76.0	5.7
Chuhar choak Peshawar road	66.8	67.4	59.4	68.1	55.4	58.2	60.1	60.0	64.2	55.9	68.1	55.4	61.6	4.7
Dhoke ratta bazaar	80.8	80.2	70.8	67.3	71.1	69.8	72.6	73.4	71.3	73.7	80.8	67.3	73.1	4.3

Table 2. Results from noise measurements on residential areas

Area	1	2	3	4	5	6	7	8	9	10	Max	Min	Mean	SD
A-Block satellite town	77.9	64.4	67.5	66.4	72.2	68.0	65.7	71.5	67.4	74.3	77.9	64.4	69.5	4.3
B-Block satellite town	58.6	59	62.1	61.4	54.6	55.8	62.5	50.8	56.3	64.2	64.2	50.8	58.5	4.2
D-Block satellite town	78.1	74.4	73.6	75.3	76.6	69.0	70.0	68.2	69.1	67.3	78.1	67.3	72.2	3.9
Dhoke khabba	56.4	58.2	60.1	52.8	56	62.2	65.1	67.8	58.7	64.6	67.8	52.8	60.2	4.7
Chaklala village nazir abad	48.5	57.9	60.1	66.7	71.6	72.9	54.0	63.2	55.0	52.3	72.9	48.5	60.2	8.3
Residential area DHA-1	50.1	58.4	54.2	56.5	49.3	61.2	55.6	52.9	60.2	54.6	61.2	49.3	55.3	4.0
Hazarat abbas colony morghah	61.5	51.2	52.4	50.2	60.9	66.3	68.8	56.7	54.4	57.3	68.8	50.2	58.0	6.3
Lal kurti residential area	59.6	58.4	64.2	59.2	66.5	67.4	55.8	52.6	60.1	68.3	68.3	52.6	61.2	5.2
Markazi jamia mosque	77.9	78.2	75.2	80.2	73.4	75.2	76.0	91.0	78.3	76.5	91.0	73.4	78.2	4.9
Askari-11 residential area	53.1	52.2	49.5	55.9	57	59.2	68.1	71.8	61.3	65.4	71.8	49.5	59.4	7.3
PIA colony	55.6	56.2	50.8	48.4	45.4	53.6	58.8	52.1	51.5	50.6	58.8	45.4	52.3	3.9
Cantt view colony	54.3	50.7	50.9	43.1	42.9	53.1	59.2	53.2	54.1	51.2	59.2	42.9	51.3	5.0
Ilyaas colony misrial road	50.0	56.5	53.7	48.2	49.6	54.2	58.6	53.5	51.8	52.4	58.6	48.2	52.9	3.2
Officers colony main entrance	55.4	54.2	57.1	52.6	48.7	47.9	56.4	57.2	58.6	49.5	58.6	47.9	53.8	3.9
Railway scheme-7	66.9	65.5	70.4	66.4	67.3	80.7	71.9	64.5	63.1	63.8	80.7	63.1	68.1	5.2
Khayabane sir syyed area	56.4	54.3	55.6	64.2	66.1	53.6	67.4	58.3	60.0	55.1	67.4	53.6	59.1	5.1
Bangash colony residential area	64.5	70.1	68.1	65.8	64.1	63.9	66.2	68.3	64.3	63.7	70.1	63.7	65.9	2.2
Workshopi mohallah area	58.2	56.7	62.2	55.2	49.8	50.3	56.9	60.1	61.4	61.0	62.2	49.8	57.2	4.4
Eid gah sihaam residential area	43.5	45.6	53.2	52.1	48.2	38.8	55.2	50.1	42.4	47.5	55.2	38.8	47.7	5.2

Table 3. Results from noise measurements on schools and colleges

School/college	1	2	3	4	5	6	7	8	9	10	Max	Min	Mean	SD
Govt.College for womens/town	65.3	64.8	63.1	77.8	67.8	70.8	68.8	68.7	70.7	72.2	77.8	63.1	69.0	4.2
Divisional public school	71.3	73.6	69.6	68.9	70.6	72.3	68.8	69.2	70.2	72.1	73.6	68.8	70.7	1.6
Asghar maal degree college	70.9	68.2	64.6	66.3	70.0	68.5	65.1	62.3	61.5	60.0	70.9	60.0	65.7	3.7
Army public school adiala road	82.1	80.6	81.5	79.9	84.6	82.3	80.0	85.6	89.8	90.1	90.1	79.9	83.7	3.8
Gordon college main gate	80.8	81.0	82.4	79.8	84.6	90.1	90.2	88.9	90.1	82.2	90.2	79.8	85.0	4.3
Gordon college inside	79.5	80.1	77.8	79.8	79.6	78.6	77.5	76.8	78.3	80.2	80.2	76.8	78.8	1.2
Army public school westridge-iii	80.8	81.0	82.4	79.8	84.6	90.1	90.2	88.9	90.1	82.2	90.2	79.8	85.0	4.3
F.G Boys school Peshawar road	82.9	77.4	75.4	71.7	84.6	79.3	80.0	87.9	90.1	70.9	90.1	70.9	80.0	6.5
Women college dhoke hassu	81.9	76.1	94.4	81.7	78.8	77.8	81.0	92.2	73.3	88.1	94.4	73.3	82.5	6.9

Table 4. Results from noise measurements in hospitals

Hospital	1	2	3	4	5	6	7	8	9	10	Max	Min	Mean	SD
Central hospital main gate	82.0	73.3	79.1	68.5	77.6	68.4	70.4	72.5	84.2	73.2	84.2	68.4	74.9	5.5
Central hospital inside	65.2	64.5	66.3	58.4	60.0	58.1	67.6	69.2	55.4	54.2	69.2	54.2	61.9	5.3
Holy family hospital inside	63.2	63.4	62.1	61.6	64.9	76.8	71.4	67.5	63.8	65.0	76.8	61.6	66.0	4.8
Holy family hospital main gate	72.2	78.3	80.3	77.1	74.9	73.6	71.9	70.0	84.4	80.3	84.4	70.0	6.3	4.6
Fauji foundation hospital	54.3	50.7	50.9	45.1	48.9	53.1	59.2	55.2	52.1	56.2	59.2	45.1	52.6	4.0
AFIC,CMH	55.3	54.9	52.8	56.3	50.6	53.7	59.5	57.6	55.7	59.2	59.5	50.6	55.6	2.8
Military hospital	60.4	63.4	63.1	59.8	64.9	70.2	68.7	67.5	63.8	62.6	70.2	59.8	64.4	3.4

Table 5. Results from noise measurements at bus stands, airport and railway stations

Site	1	2	3	4	5	6	7	8	9	10	Max	Min	Mean	SD
Pir Wadhai bus stand	82.6	80.4	82.2	85.3	68.4	80.3	72.8	74.1	75.9	68.1	85.3	68.1	77.0	6.1
Pir Wadhai bus stand main entrance	80.2	78.7	78.6	79.9	78.3	80.2	81.2	78.2	80.6	86.4	86.4	78.2	80.2	2.4
Islamabad International airport	59.2	67.4	72.6	70.7	71.9	74.0	69.1	77.2	101.2	102.5	102.5	59.2	76.6	14.1
Chaklala railway station	50.0	43.8	56.2	53.2	71.0	72.4	62.2	53.7	51.1	50.8	72.4	43.8	56.4	9.3
Sowan wagon stand	65.5	60.6	70.4	62.3	61.9	67.5	83.4	70.4	66.8	72.8	83.4	60.6	68.2	6.7
Rawalpindi Railway station outside	78.3	79.0	78.6	78.8	79.3	76.8	75.4	79.6	80.1	81.0	81.0	75.4	78.69	1.61
Rawalpindi Railway station inside	77.6	76.4	73.8	72.3	75.9	76.3	77.7	77.4	76.5	75.7	77.7	72.3	75.96	1.72
Pir Wadhai bus stand	82.6	80.4	82.2	85.3	68.4	80.3	72.8	74.1	75.9	68.1	85.3	68.1	77.01	6.06

Table 6. Results from noise measurements in markets and shopping plazas

Market/plazas	1	2	3	4	5	6	7	8	9	10	Max	Min	Mean	SD
Food street cricket stadium	67.7	59.4	71.5	67.1	68.9	72.9	70.0	66.0	69.8	68.5	72.9	59.4	68.2	3.7
Shamas abad furniture market	64.5	69.5	68.5	63.8	62.4	71.4	64.7	64.0	63.2	66.4	71.4	62.4	65.8	3.0
Commercial market sat/town	68.9	65.4	67.3	64.3	69.1	72.5	73.4	74.3	75.1	75.9	75.9	64.3	70.6	4.2
Rahman abad choak market	75.2	76.4	68.8	63.6	72.6	73.1	74.7	76.6	65.9	70.0	76.6	63.6	71.7	4.5
National market satellite town	66.5	67.3	70.1	72.5	60	62.6	71.7	70.3	66.8	78.3	78.3	60.0	68.6	5.2
Chaklala market	54.6	53.8	59.1	69.0	55.1	59.4	55.2	66.7	58.5	56.4	69.0	53.8	58.8	5.2
Sadar kamran market	75.4	76.2	75.8	79.6	77.9	80.2	81.0	79.8	80.3	78.5	81.0	75.4	78.5	2.1
Bohar bazaar	75.0	69.7	64.4	70.4	68.7	70.3	74.4	80.1	67.3	72.2	80.1	64.4	71.3	4.4
Wesrtidge market	78.2	78.4	77.6	80.1	79.6	78.8	76.9	76.5	81.2	80.1	81.2	76.5	78.7	1.5
Westridge market post office	76.4	76.8	81.0	79.2	78.6	78.4	79.3	74.8	76.7	77.9	81.0	74.8	77.9	1.8
Khayabane sir syyed market	80.8	80.2	70.8	67.3	71.1	69.8	72.6	73.4	71.3	73.7	80.8	67.3	73.1	4.3

Table 7. National environmental quality standards (NEQS) for noise effective from 1st July, 2012

Category of area/zone	dB(A) L_{eq}	
	Day time	Night time
Residential area	55	45
Commercial area	65	55
Industrial area	75	65
Silence zone	50	45

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can cause harmful effects on human health, animals and the environment. Motor vehicular traffic using pressure horns, musical systems and ill tuned engins are the main source of noise pollution at main roads as well as residential areas, main entrances of hospitals and educational institutions situated near roads. The problem of traffic noise created by these vehicles is a significant source of noise pollution in areas near roads and bus stands. Air conditioners, fans and generators cause noise pollution to some extent in markets and shopping plazas.

Table 8. WHO guideline values for community noise in specific environments, April 1999

Specific environment	L_{eq} [dBA]	L_{max}, fast [dBA]
Outdoor living area	55	-
Dwelling, indoors	35	45
Inside bedrooms	30	45
Outside bedrooms	45	60
School class rooms and Pre-schools, indoors	35	-
Pre-school bedrooms, indoors	30	45
School, playground outdoor	55	-
Hospital, ward rooms, indoors	30	40
Industrial, commercial shopping and traffic areas, indoors & outdoors	70	110
Ceremonies, festivals and entertainment events	100	110
Public addresses, indoors and outdoors	85	110
Music through headphones/ earphones	85	110

During load shedding of electricity, mostly generators are used to generate electricity. These are creating too much noise in commercial areas. Excessive use of loudspeakers and musical equipments in musical centers is causing noise pollution in markets and shopping plazas. Overcrowding of people is creating noise in markets, schools, colleges, hospitals, bus stands airports and railway stations. Unplanned urbanisation has severly damaged the natural green areas of the city. These all are contributing to noise pollution, which can cause health problems to the exposed population of the city. Present study will certainly divert attention of the concerned implementing authorities to understand the severity of the noise pollution problem of the city and take proper remedial measures.

Recommendations

- To wear ear protection, while working in noisy conditions is an effective way to manage noise. Vehicles and factory machines need to be maintained properly and checked from time to time.
- Sound insulation at the top of the roof and addition of a layer of plasterboard or wood to the dividing wall can provide a protection from the noise.
- A comprehensive campaign should be launched to create public awareness about noise pollution.
- Effective solution for noise pollution is to plant bushes and trees around the sound generating sources. Planned housing schemes should be allowed which must have green areas.
- Use of loudspeakers at public places, use of pressure horns and sound systems in buses and other transport vehicles should be banned and strict laws should be imposed against them.
- For overcoming the effects of noise pollution latest active noise control (ANC) technologies should be used such as white noise machine. This device converts the unbearable noise into pleasant sound.

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