

**SPATIAL AND TEMPORAL ANALYSIS OF TRAFFIC NOISE
POLLUTION ON 9th AVENUE, ISLAMABAD**



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ABSTRACT

Noise pollution is a major environmental issue now a days in Islamabad. Noise pollution is a threat to human wellbeing, and it is most under rated environmental issue because one cannot smell, taste, or see it. Noise pollution becomes threat to residents of Islamabad due to rapid increase in urbanization and industrialization. Traffic noise pollution is one of the major environmental issue presently due to increase in number of vehicles. The study is based upon the traffic noise pollution of one of the busiest route of Islamabad (9th Avenue) which connects twin cities (Islamabad and Rawalpindi). The objective of study was to affirm whether traffic noise pollution is in compliance with National Environmental Quality Standards or not. Traffic noise pollution was measured by digital sound level meter. The study area was 7.6 kilometers long and data was collected after interval of 800 meters. 10 points were taken in a distance of 7.6 kilometers. The study period was 4 weeks from 11th November to 6th December 2019. Data were collected twice a day from Monday to Friday at morning and evening time. Minimum value of traffic noise recorded at 9th Avenue was 65.8 dBA and maximum value was 98.0 dBA. Minimum average value of traffic noise was 70.8 dBA and maximum average value was 94.5 dBA. After analysis of results it was concluded that traffic noise pollution level of 9th avenue is exceeding the standard of NEQS in all points.

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ABBREVIATIONS

NEQS	National Environmental Quality Standards
EPA	Environmental Protection Agency
WHO	World Health Organization
dB	Decibels
°C	Celsius
Hz	Hertz

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CHAPTER 1

INTRODUCTION

1.1 Noise Pollution

Noise is one of the environmental pollution, which is serious environmental issue for the human. In urban cities, noise pollution is major subject around the globe. Noise is defined as any unwanted and irritating sound. Noise pollution affects the environment, biodiversity, and the well-being of humans. It's magnitude and severity are increasing day by day due to rapid increase in population, urbanization, industrialization and increase in number of mobile sources of noise pollution i.e. heavy vehicles such as buses, cargo trucks, vehicles with siren, private cars, and motorbikes. It will also continue to grow due to sustained growth in air traffic, rail, and highway, which remain main cause of environmental noise (Hiral Jariwala et al 2017).

Noise is annoying to every individual. Human response to noise pollution is subjective and differ greatly from each other Sound is produced due to change in pressure levels of air. The intensity of these pressure changes is quantified in terms of sound levels expressed by decibels (dB). (Tattai et al., 2017). Human ear is very sensitive to detect the slight variation in frequency of sound. Human ear can detect smallest change in sound which is about 3dBA and increase of 5dBA is clearly perceptible. Numerous factors can influence individual response like frequency, loudness, amount of background noise, and time pattern (Jeremy Gelb and Philippe Apparicio 2020)

Audible frequency range of healthy human ear is from 20Hz to 2000Hz. Threshold value of hearing is ranges from 0dB to 10dB, which is not detectable to everyone. Typically, sound is measured by using small gadget called, sound level meter. Sound level meter, measures sound in unit of decibels (dB)

1.2 Traffic Noise Pollution and its Sources

Traffic noise pollution is a major subject of environmental pollution in today's world. It has become a global problem because cities are planned without buffer zones. It poses severe risks to environment, biodiversity, and human wellbeing. Traffic noise

pollution is increasing day by day due to change in trend of using public transport. Now a day's people prefer their own vehicles which contributes to traffic noise pollution to the extent of damaging ecosystem's wellbeing.

With growth and urbanization of our cities and towns, there has been rapid increase in traffic flow on the roadways though transportation is an essential part of the today's society, its perks may be over shaded by its limitations and is a cause for concern for a community. The transportation facilities like cars, buses, coasters, tractors, trucks, motorbikes, and private cars contribute to traffic noise pollution at roadways. Different transportation systems modes have different scale of noise emissions. The intensity is directly linked with magnitude of traffic (Murat and Elif 2016)

There are many factors which contribute to traffic noise pollution. Noise pollution depends upon the type of vehicle because of their height and size of engines. Increase in speed of vehicle by 10 miles per hour can double the effect of sound. Tires types and condition can cause up to 10dBA variation in effect of sound. Types of road surface can contribute to noise pollution up to 4dBA (Saba Ismail and Shahid Ahmed 2018)

Traffic noise pollution is a major environmental issue on 9th avenue. 9th avenue is the busiest route of Islamabad at morning and evening times. There are numerous sources of traffic noise pollution at 9th avenue which degrades the environment, such as

Sources of traffic noise pollution at 9th Avenue are:

1. Motorbikes
2. Private cars
3. Cargo trucks (small and medium)
4. Waste dumping trucks and tractors
5. School vans
6. Buses, cabin cars and coasters
7. Emergency vehicles (ambulance, fire brigade, police car)

1.3 Traffic Noise Pollution and its Standards

Noise pollution is a major threat to the wellbeing of human health, environment, and biodiversity. World Health Organization and Pakistan Environmental Protection Agency provide standards for controlling the noise pollution of different areas and zones. The objective of standards is to protect the environment, human health, and biodiversity from adverse impact of noise.

1.3.1 NEQS for Noise Pollution

Pakistan Environment Protection Agency provides the quality standards for the controlling noise pollution and divide these standards for four different zones which are residential, industrial, commercial areas, and silence zones. Noise value for daytime and nighttime are different for each area/zone as shown in table 1.1.

Table 1.1 National Environmental Quality Standards for noise

No.	Category of Area/Zone	Limits in dB(A) $L_{(eq)}$	
		Day Time	Nighttime
1	Residential area (A)	55	45
2	Commercial area (B)	65	55
3	Industrial area (C)	75	65
4	Silence zone (D)	50	45

Note:

- I. Day time hours; 6:00 am to 10:00 pm
- II. Nighttime hours; 10:00 pm to 6:00 am
- III. Silence zone; an area comprising not less than 100 meters around hospitals, educational institutes, and courts. Declared by competent authority.

1.3.2 WHO Standards for Noise Pollution

The different standards of noise pollution provided by the World Health Organization are based on the different environment for the specific period of time.

Highest noise standard of 100 dBs for entertainment and festivals with exposure time of only 4 hours as shown in table 1.2.

Table 1.2: WHO standards for noise pollution

No.	Specific Environment	L6A _{eq} (dB)	Time base (hours)
1	Outdoor living area	55	16
2	Schools classrooms	35	During class
3	Hospital ward rooms	30	8
4	Commercial	70	24
5	Playgrounds	55	During play
6	Festival, Entertainment	100	4
7	Public address	85	1

1.4 Effect of Traffic Noise Pollution

Vehicle noise is a main source of community noise and people are more exposed than other forms of noise. This type of noise has a strong connection with disturbance and causes insomnia particularly at night. Non-Stop high-level noise can lead to physical, psychological, and physiological problems as well as effect on work performance of individual (Vibhav Singh et al., 2018).

1.4.1 Effect on Biodiversity

Multiple evidences suggest that the main factor in the continuous loss of numbers in population of wildlife near roads in traffic noise. Birds that communicate at frequencies similar to road noise tend to avoid roads than the species that communicate at higher frequencies. Noise pollution from the traffic directly affect the bird with song frequency shifts under the noise pollution. Species like frogs, birds and mammal can change their way of communication around traffic or other anthropogenic noise to avoid masking effect (Christopher J. W. McClure et al., 2013).

Sound may have tolerable influence on animals, however when sound turns into noise, it causes disturbance. Animals communicate in sound, however when heavy noise coming from roads would affect, their communication. This problem influences several biological groups and some ecosystems like terrestrial, aquatic, and coastal (Romain Sordello et al., 2019).

Noise pollution produced by traffic and machinery is recognized as a significant human health problem, with noise levels is increasing day by day. Effects on specific species of animals and plants are known, however we have to understand the wider effects of noise on ecosystem and biodiversity thoroughly one to be understood. Some species avoid noisy areas, possibly because noise pollution interferes with communication or their capability to find prey. Many species enjoy living in noisy areas and used noisy area as a refugee because there is absence of predators or their competing species (Javad Hatamzadi et al 2018)

Due to noise pollution several challenges faced by enormous distinct species and habitats. The workers have different kind of protected equipment when they are worked somewhere like in industries or construction site. In the case of sparrows, mice, snakes, and different animals that may occupy the zone have no such extravagance (Margaritis and Kang 2016)

1.4.2 Effect on Human Health

Noise pollution poses a serious threat to human wellbeing. It can cause physiological and psychological disorders to human being. Noise pollution can also cause hearing loss, pain, hypertension, cardiovascular and vasoconstriction (P. Amrutha Preethi et al 2016).

There are various psychological issues arising from the noise pollution such as insomnia, going to sleep late, frustration and stress. Noise pollution also influences on work performance such as reduction of productivity and misinterpretation of what is heard. Therefore, evaluating the problem and programming action for regulating noise and its undesirable consequences have become an issue of immediate concern for public (Vibhav Singh et al 2018). Disturbance caused by noise change the quantity and quality of sleep. Difficulty in sleeping, awakenings, and changes in sleep stages, especially a reduction in rapid eye movement. Traffic noise above than 30dB sufficient to disrupt the sleep. Traffic noise is associated with production losses caused by an inability to focus on work. A guide to noise threshold levels as indicated in table. (Malik Muhammad Anees et al 2014).

Table 1.3: Health effects and their threshold level (dB)

Health Effects	Threshold level(dB)
Stress related health effect performance	55
Cardiovascular effects	65
Hypertension	70
Cardiac Diseases	70
Loss of hearing	70

There are various physiological issues arises from the noise pollution such as sleeplessness, variation in skin color, hearing damages that extends from temporary threshold shift through permanent threshold turn to deafness. According to medical specialists, noise pollution in cities puts greatest threat to unborn babies and kids. Excessive noise exposure can cause both anatomical abnormalities and more subtle deviations in human and metabolic functions. Loud noise is believed to cause dilated pupils, constricts blood vessels, create cardiac and intestinal ailment in kids. Noise interferes with communication, sleep quality and learning. (Patel Ankur et al 2016).

The consequences of environmental noise may be estimated by assessing its intrusion with social conduct and other actions. For many community noises, interference with rest/recreation/watching television appear to be the most critical impacts. There is reasonably trustworthy evidence that noise above 80 dBA causes lowered helping behavior, and that loud noise also boosts aggressive behavior in individuals which are susceptible to aggressiveness. In school children, there is also concern that high levels of chronic noise leads to thoughts of helplessness (Birgitta Berglund et al 2013).

1.4.3 Effect on Environment

Loud noise is dangerous to the built environment both property and life. The adverse impact of noise on the built environment increases with the noise level and depend upon source distance. The impact also changes with the time of the day. Noise level which is tolerable at the daytime might causes discomfort at nighttime. The degree of the adverse

impact may also vary with location. People from urban areas are usually more tolerant of noise than people from rural areas. Unexpected and highly intense noise level will cause more harm than monotonous noise. Degree of disturbance and impacts caused by noise greatly depends on individual (R.N. Pantawane et al 2017)

Traffic noise pollution has a cost due to its effects on human health, and ecological component of environment. Like the other cost of traffic like air pollution, this cost is not negligible. This issue must be raised and awareness to be created in communities and government for avoiding the negative impact of noise. Communities must take the action to reduce traffic noise by following the legislation which forces the manufacture to design the vehicles with minimum noise level (Nicolas Pignier 2015).

Noise pollution has a strong impact on introducing uneasiness in the life of people as the societies and the urban areas getting compacted as well as densely populated gradually. The noise pressure of particular zone varies with the receiving materials of the environment (Yang and Yi, 2011).

1.5 Aims and Objectives of the Study

Aim of this study is to identify the extent or level of noise in the busy road of Islamabad city. To accomplish this aim, a research work has been carried out keeping in mind the following objectives:

1. To measure traffic noise pollution at 9th Avenue, Islamabad.
2. To analyze the data for compliance check of traffic noise with permissible limits provided by NEQS.

CHAPTER 2

MATERIALS AND METHODS

2.1 Study Area

The study area selected was 9th avenue, also known as Agha Shahi Avenue located in Islamabad. The 9th avenue is joining twin cities Islamabad and Rawalpindi. It was elongated between Sector F-8, G-8, H-8, I-8 and F-9, G-9, H-9, I-9. It begins from Margalla road and end at junction of IJP road. The length of this avenue is 7.6 kilometers m (7600 m). This avenue being one of the busiest route in Islamabad was selected for this study. The traffic flow is continuous at 9th avenue during morning and evening time because people of both cities travel to go their offices, schools, and universities etc. through this route.

The 9th avenue is surrounded by beautiful greenbelts. Residential, commercial, industrial areas and silence zone are located beyond greenbelts.

Ten points were chosen on the 9th avenue after interval of 800 m for primary data collection on traffic noise as indicated in table 2.1.

Table 2.1: Sampling locations for recoding noise levels at 9th avenue

Points	Nearby Locations	Latitude	Longitude
01	Shaheen Chowk	33°42'45''N	73°01'36''E
02	Islamabad Traffic Police Office	33°42'23''N	73°01'52''E
03	Eleven Star Cricket Ground	33°42'00''N	73°02'10''E
04	Sector G-8 Exit	33°41'40''N	73°02'42''E
05	Kashmir Highway Exit	33°41'16''N	73°02'43''E
06	End of Peshawar Morr Bridge	33°40'52''N	73°03'01''E
07	Faiz Ahmad Faiz Metro Station	33°40'32''N	73°03'16''E
08	Khayaban-e-Johar Metro Station	33°40'07''N	73°03'35''E
09	Underpass	33°39'46''N	73°03'51''E
10	Traffic Signal	33°39'22''N	73°04'08''E

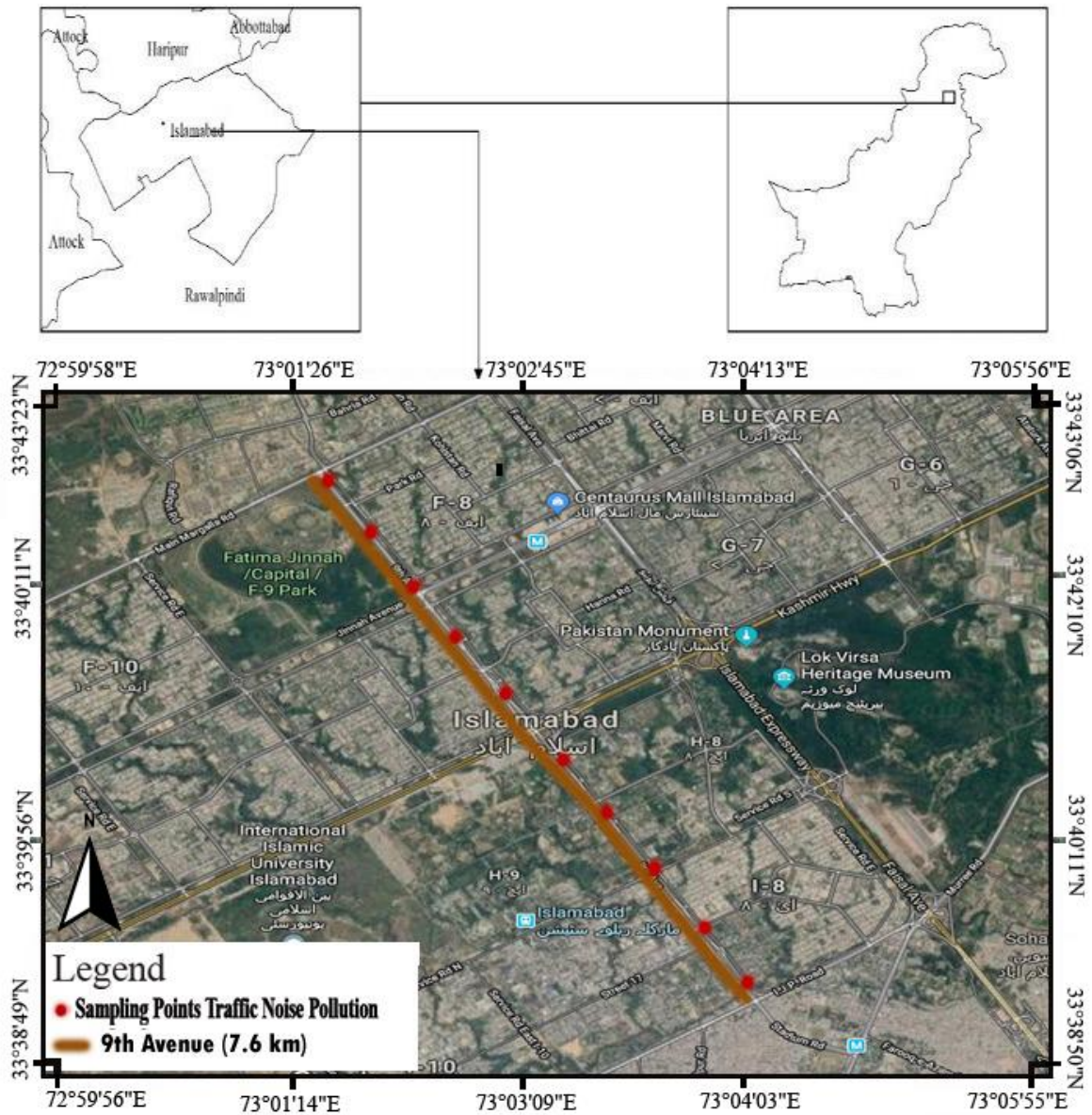


Figure 2.1: Map of 9th avenue Islamabad showing sampling points

2.2 Materials

2.2.1 Digital sound level meter:

Digital sound level meter (Model no. JK-NM-814) was used for recording traffic noise levels during the study. Sound level meter has a measurement range of 30 dBA to 130 dBA and frequency is 31.5 Hz to 8.5 kHz. The response time of sound level meter has a 0.5

second in Fast option whereas 1 second time for slow option. The limitation of this device is in its operation conditions, i.e., relative humidity should be less than 99% and temperature range of 0°C to 40°C. The sound level meter was placed at 1.2 to 1.5 meters above the ground level on the stand.



Figure 2.2: Digital sound level meter

2.2.2 Digital Watch:

During data collection, digital watch has been used to measure time. At every point three readings were taken after interval of 2 minutes. After every 2 minutes reading was recorded on digital sound level meter for 20 seconds., then maximum value was recorded from the digital sound level meter. Stopwatch was used for recording time.

2.3 Methods:

Primary data on traffic noise were collected from every point by a digital sound level meter. Three readings were taken at each point after the interval of two minutes after that average is calculated. As shown in table 2.2.

Table 2.2: Example showing the measurement noise level at each point

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	75.5	70.4	71.2	71.2
02	79.3	82.9	86.4	86.4
03	84.7	81.5	78.9	78.9

Study period for data collection was for 4 weeks from Monday to Friday as indicated in table 2.3

Table 2.3: Weeks for measurement of noise levels

Weeks	Monday to Friday
01	11 th November to 15 th November
02	18 th November to 22 nd November
03	25 th November to 29 th November
04	2 nd December to 6 th December

Data was collected twice a day in rush hours at morning and evening time from Monday to Friday. The morning time was from 9:30 am to 11:00 am and evening time was from 6:00 pm to 7:30 pm as indicated in table 2.4.

Table 2.4: Sessions and timing for measurement of noise levels

Sessions	Timing
Morning	9:30 am to 11:00am
Evening	6:00 pm to 7:30 pm

After the data was collected, data was analyzed and then compared with NEQS of Pakistan as given in chapter 3.

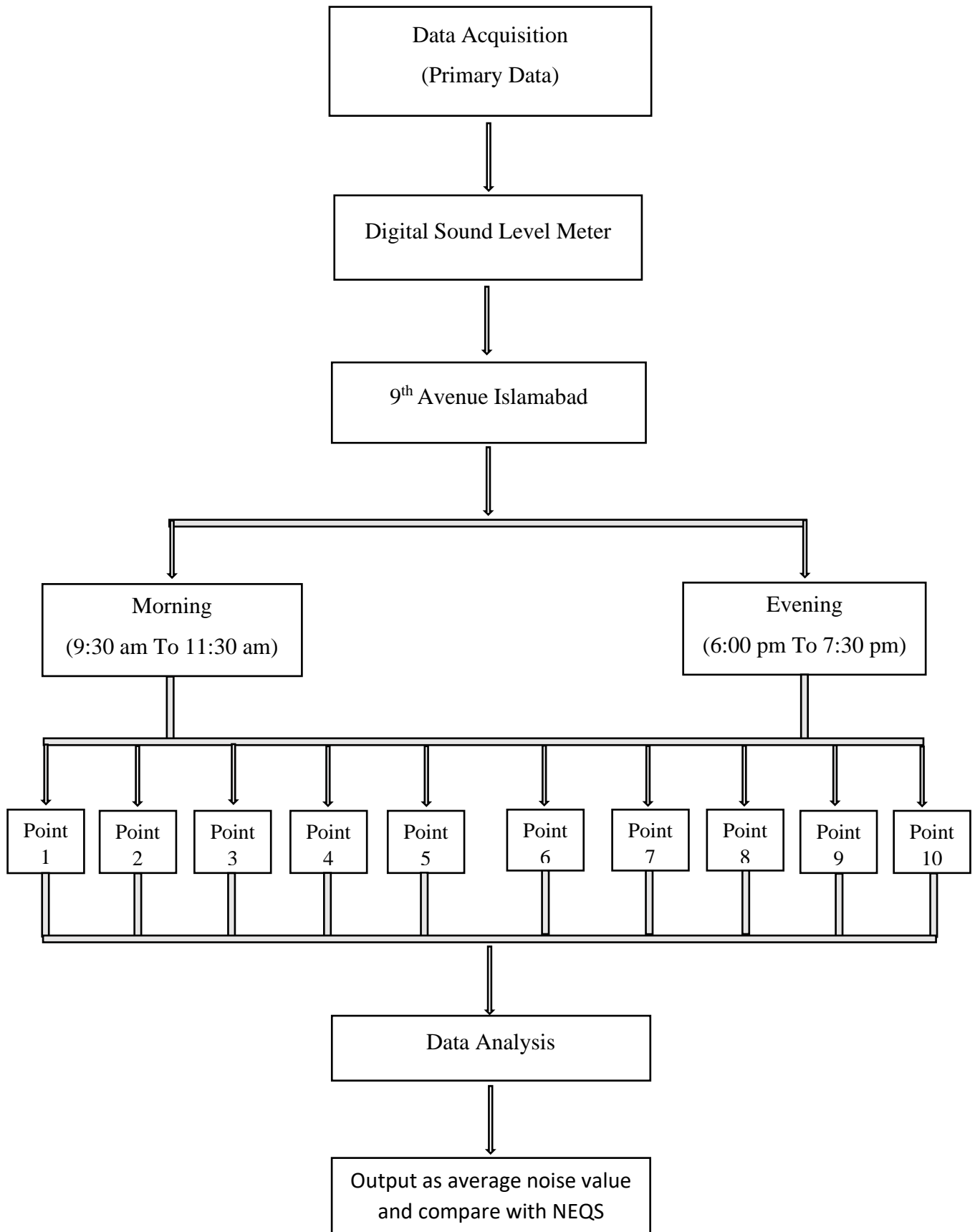


Figure 2.3: Research methodology flow chart.

CHAPTER 3

RESULTS AND DISCUSSION

Ten points were chosen on 9th avenue for data collection. These points were split according to sectors for analysis. Sector F-8 and F-9 comprised of points 1, 2 and 3, G-8 and G-9 comprised of points 4 and 5, H-8 and H-9 comprised of points 6 and 7 and I-8 and I-9 comprised of points 8, 9 and 10. The average value of traffic noise of the whole week of each point was compared with NEQS, established by the Pakistan Environmental Protection Agency for respective areas and zones.

Comparison of average value of each point in morning and evening session data of weeks with NEQS with their respective zone:

As discussed earlier, that study was conducted for four successive weeks. The average value of the whole week was calculated on each point after that compared with NEQS according to their respective areas and zones. Assume that traffic noise level on 9th avenue was the same on both sides. The average value of traffic noise compared with NEQS according to their respective areas and zones, on both sides of the 9th avenue for morning and evening sessions.

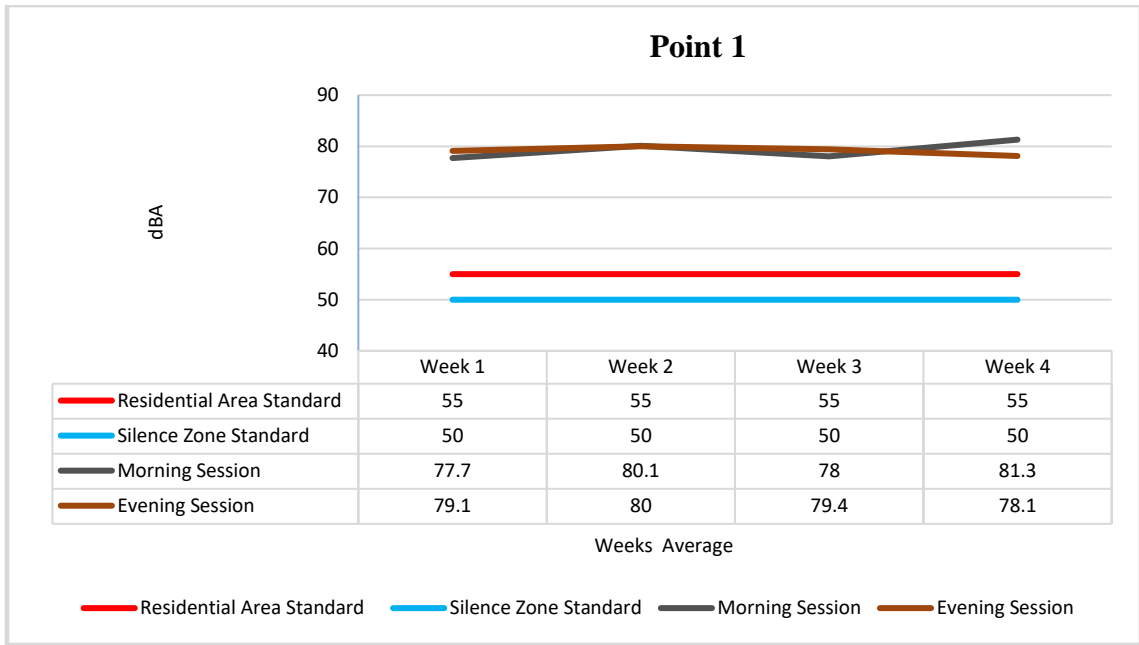


Figure 3.1: Comparison of average values of weeks of point 1 with NEQS

Figure 3.1 shows that average value of traffic noise of weeks on point 1 compared with NEQS (Table 1.1). Point 1 was located between sector F-8 and F-9. Sector F-8 comprised of residential area where as F-9 comprised of Silence zone. The standard value established by Pakistan Environmental Protection Agency for residential area and silence zone are 55 dBA and 50 dBA, respectively. The average value of point 1 was compared with NEQS according to respective zones i.e. residential area and silence zone. Minimum average value on point 1 in morning session was 77.7 dBA and for evening session was 78.1 dBA. Maximum average value on point 1 in morning session was 81.3 dBA and for evening session was 80.0 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 1 with other weeks in both morning and evening sessions. All value ranges from 77.7-81.3 dBA and these values are clearly surpassing standard value of noise in residential area and silence zone i.e. 55 dBA and 50 dBA, respectively.

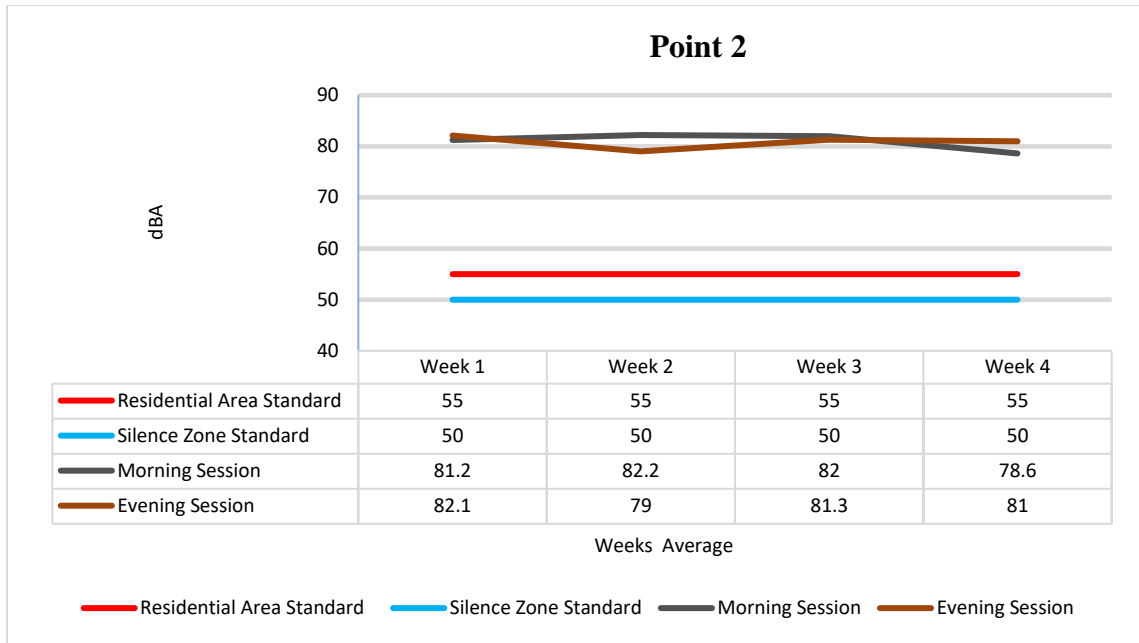


Figure 3.2: Comparison of average values of weeks of point 2 with NEQS

Figure 3.2 shows that average value of traffic noise of weeks on point 2 compared with NEQS (Table 1.1). Point 2 was located between sector F-8 and F-9. Sector F-8 comprised of residential area where as F-9 comprised of Silence zone. The standard value established by Pakistan Environmental Protection Agency for residential area and silence zone are 55 dBA and 50 dBA, respectively. The average value of point 2 was compared with NEQS according to respective zones i.e. residential area and silence zone. Minimum average value on point 2 in morning session was 78.6 dBA and for evening session was 79.0 dBA. Maximum average value on point 2 in morning session was 82.2 dBA and for evening session was 82.1 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 2 with other weeks in both morning and evening sessions. All value ranges from 78.6-82.2 dBA and these values are clearly surpassing standard value of noise in residential area and silence zone i.e. 55 dBA and 50 dBA, respectively.

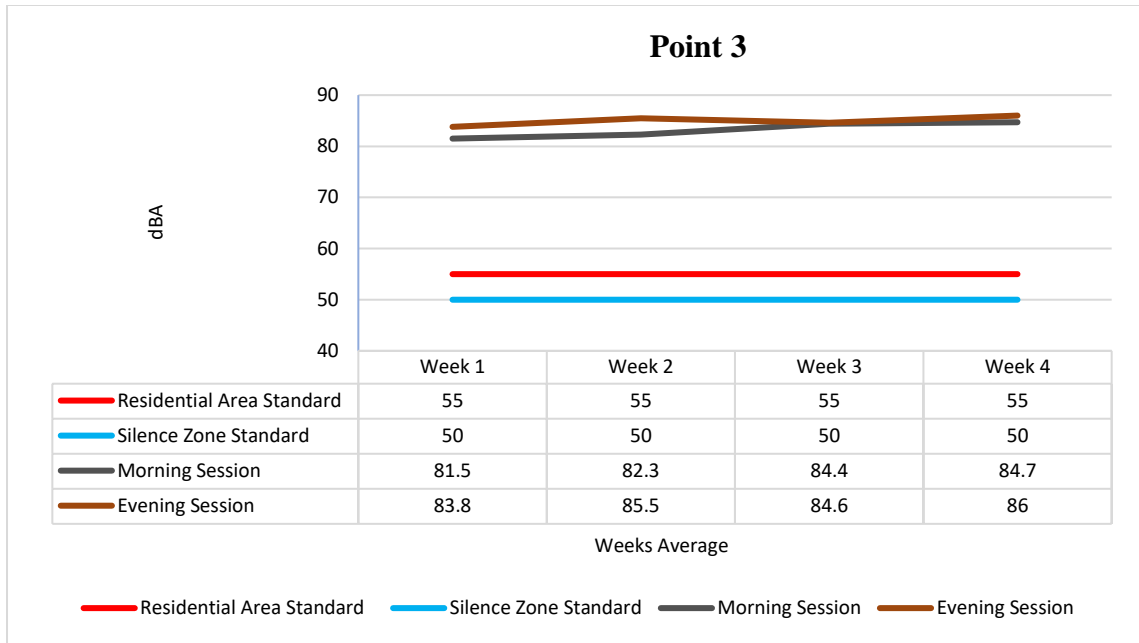


Figure 3.3: Comparison of average values of weeks of point 3 with NEQS

Figure 3.3 shows that average value of traffic noise of weeks on point 3 compared with NEQS (Table 1.1). Point 3 was located between sector F-8 and F-9. Sector F-8 comprised of residential area where as F-9 comprised of Silence zone. The standard value established by Pakistan Environmental Protection Agency for residential area and silence zone are 55 dBA and 50 dBA, respectively. The average value of point 3 was compared with NEQS according to respective zones i.e. residential area and silence zone. Minimum average value on point 3 in morning session was 81.5 dBA and for evening session was 83.8 dBA. Maximum average value on point 3 in morning session was 84.7 dBA and for evening session was 86.0 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 3 with other weeks in both morning and evening sessions. All value ranges from 81.5-86.0 dBA and these values are clearly surpassing standard value of noise in residential area and silence zone i.e. 55 dBA and 50 dBA, respectively.

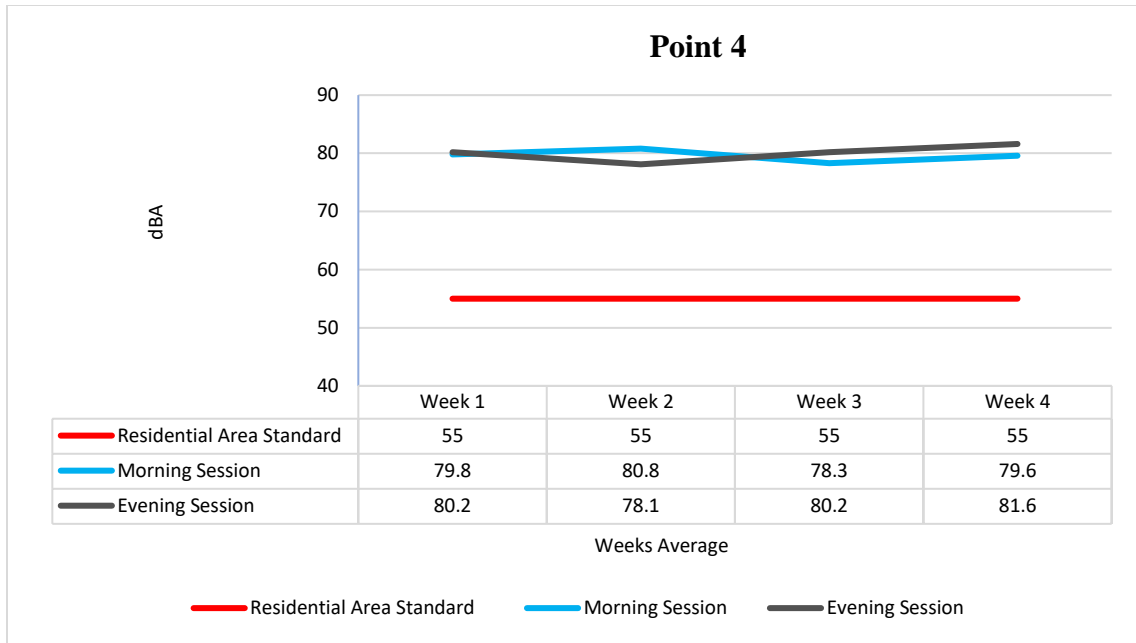


Figure 3.4: Comparison of average values of weeks of point 4 with NEQS

Figure 3.4 shows that average value of traffic noise of weeks on point 4 compared with NEQS (Table 1.1). Point 4 was located between sector G-8 and G-9. Sector G-8 and G-9 both comprised of residential area. The standard value established by Pakistan Environmental Protection Agency for residential area are 55 dBA. The average value of point 4 was compared with NEQS according to respective zones i.e. residential area. Minimum average value on point 4 in morning session was 78.3 dBA and for evening session was 78.1 dBA. Maximum average value on point 4 in morning session was 80.8 dBA and for evening session was 81.6 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 4 with other weeks in both morning and evening sessions. All value ranges from 78.1-81.6 dBA and these values are clearly surpassing standard value of noise in residential area i.e. 55 dBA.

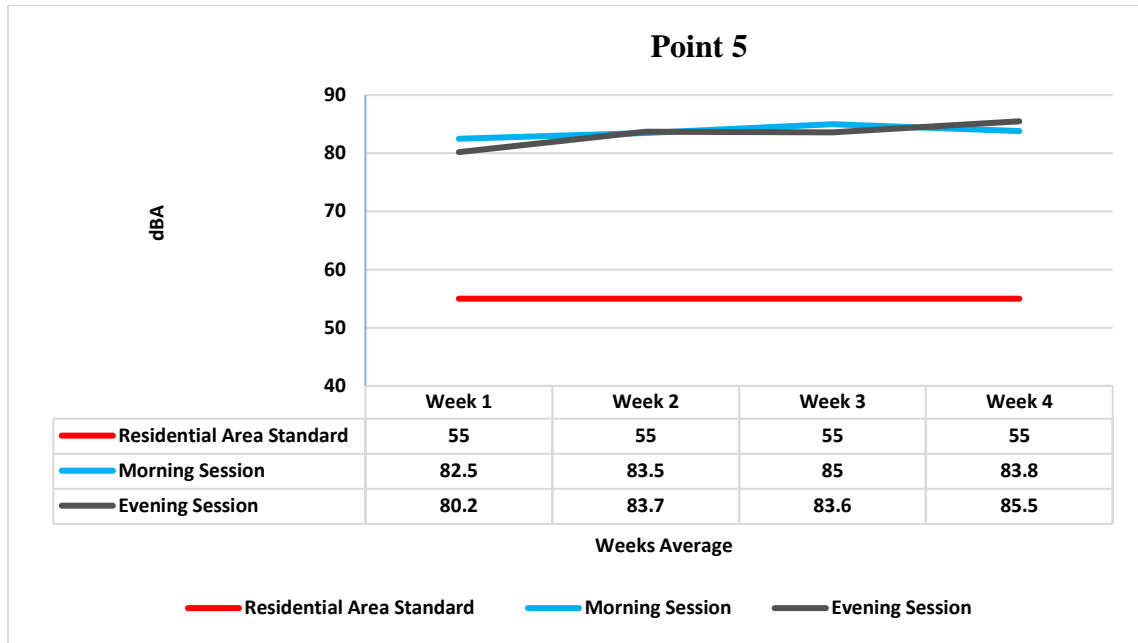


Figure 3.5: Comparison of average values of weeks of point 5 with NEQS

Figure 3.5 shows that average value of traffic noise of weeks on point 5 compared with NEQS (Table 1.1). Point 5 was located between sector G-8 and G-9. Sector G-8 and G-9 both comprised of residential area. The standard value established by Pakistan Environmental Protection Agency for residential area are 55 dBA. The average value of point 5 was compared with NEQS according to respective zones i.e. residential area. Minimum average value on point 5 in morning session was 82.5 dBA and for evening session was 80.2 dBA. Maximum average value on point 5 in morning session was 85.0 dBA and for evening session was 85.5 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 5 with other weeks in both morning and evening sessions. All value ranges from 80.2-85.5 dBA and these values are clearly surpassing standard value of noise in residential area i.e. 55 dBA.

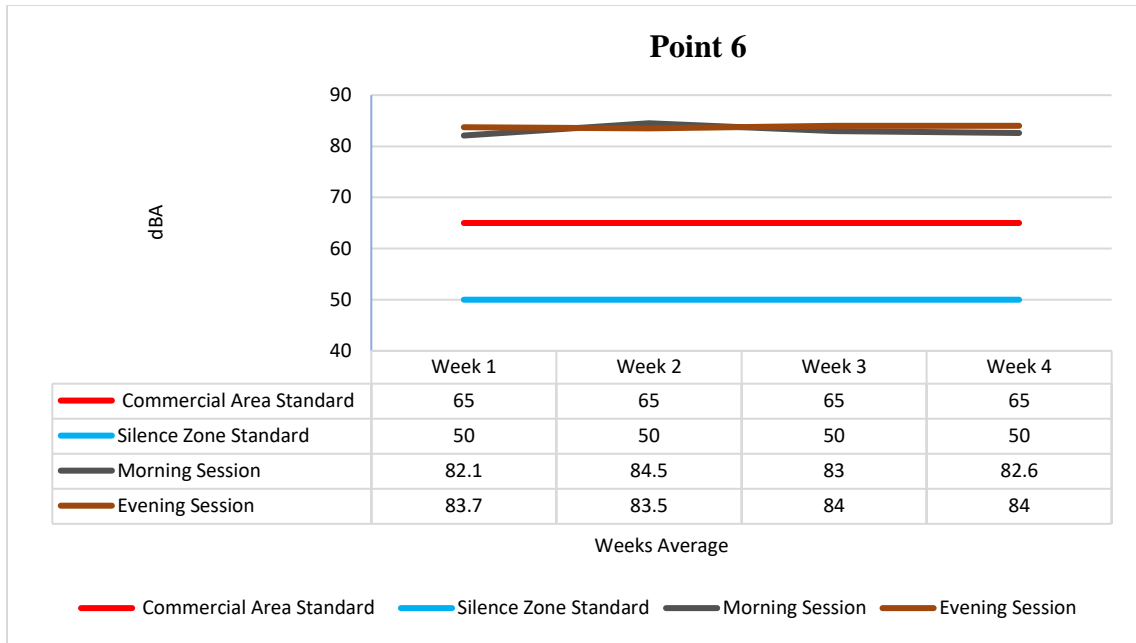


Figure 3.6: Comparison of average values of weeks of point 6 with NEQS

Figure 3.6 shows that average value of traffic noise of weeks on point 6 compared with NEQS (Table 1.1). Point 6 was located between sector H-8 and H-9. Sector H-8 comprised of silence zone where as H-9 comprised of commercial area. The standard value established by Pakistan Environmental Protection Agency for silence zone and commercial area are 50 dBA and 65 dBA, respectively. The average value of point 6 was compared with NEQS according to respective zones i.e. silence zone and commercial area. Minimum average value on point 6 in morning session was 82.1 dBA and for evening session was 83.7 dBA. Maximum average value on point 6 in morning session was 84.5 dBA and for evening session was 84.0 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 6 with other weeks in both morning and evening sessions. All value ranges from 82.1-84.5 dBA and these values are clearly surpassing standard value of noise in silence zone and commercial area i.e. 50 dBA and 65 dBA, respectively.

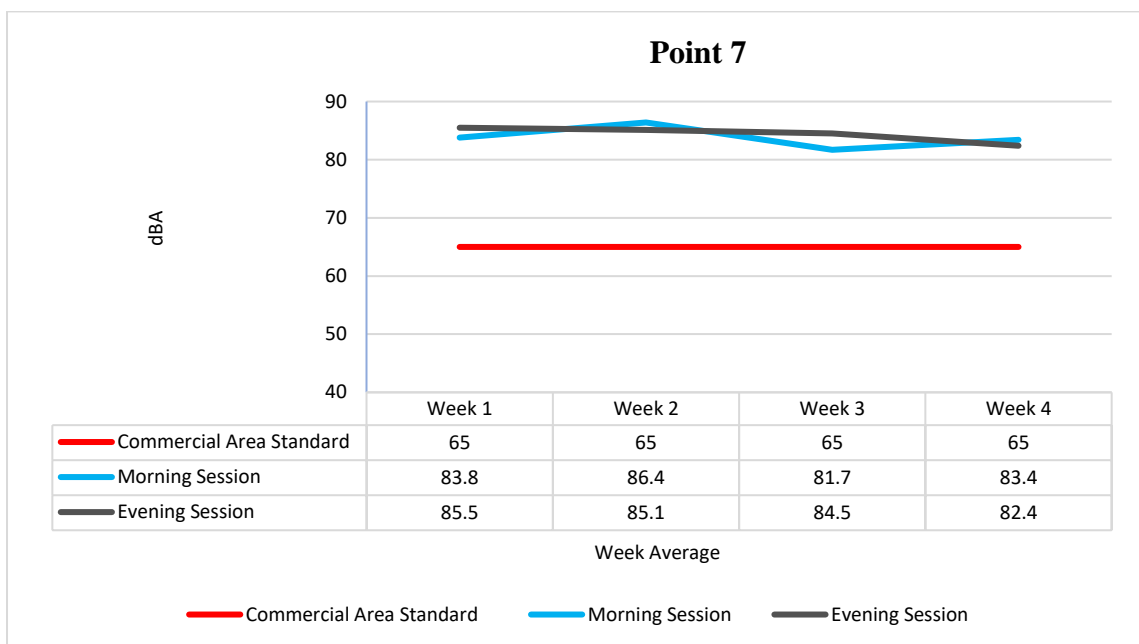


Figure 3.7: Comparison of average values of weeks of point 7 with NEQS

Figure 3.7 shows that average value of traffic noise of weeks on point 7 compared with NEQS (Table 1.1). Point 7 was located between sector H-8 and H-9. Sector H-8 and H-9 both comprised of commercial area. The standard value established by Pakistan Environmental Protection Agency for commercial are 65 dBA. The average value of point 7 was compared with NEQS according to respective zones i.e. commercial area. Minimum average value on point 7 in morning session was 81.7 dBA and for evening session was 82.4 dBA. Maximum average value on point 7 in morning session was 86.4 dBA and for evening session was 85.5 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 7 with other weeks in both morning and evening sessions. All value ranges from 81.7-86.4 dBA and these values are clearly surpassing standard value of noise in commercial area i.e. 65 dBA.

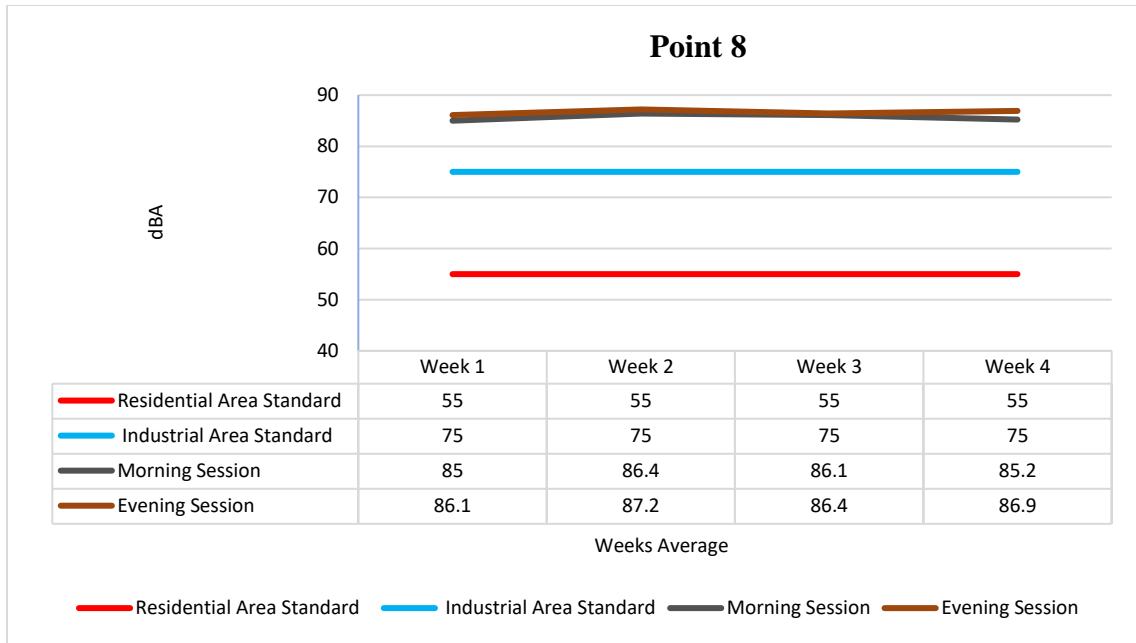


Figure 3.8: Comparison of average values of weeks of point 8 with NEQS

Figure 3.8 shows that average value of traffic noise of weeks on point 8 compared with NEQS (Table 1.1). Point 8 was located between sector I-8 and I-9. Sector I-8 comprised of residential area where as I-9 comprised of industrial area. The standard value established by Pakistan Environmental Protection Agency for residential area and industrial area are 55 dBA and 75 dBA, respectively. The average value of point 8 was compared with NEQS according to respective zones i.e. residential area and industrial area. Minimum average value on point 8 in morning session was 85.0 dBA and for evening session was 86.1 dBA. Maximum average value on point 8 in morning session was 86.4 dBA and for evening session was 87.1 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 8 with other weeks in both morning and evening sessions. All value ranges from 85.0-87.1 dBA and these values are clearly surpassing standard value of noise in residential area and industrial area i.e. 55 dBA and 75 dBA, respectively.

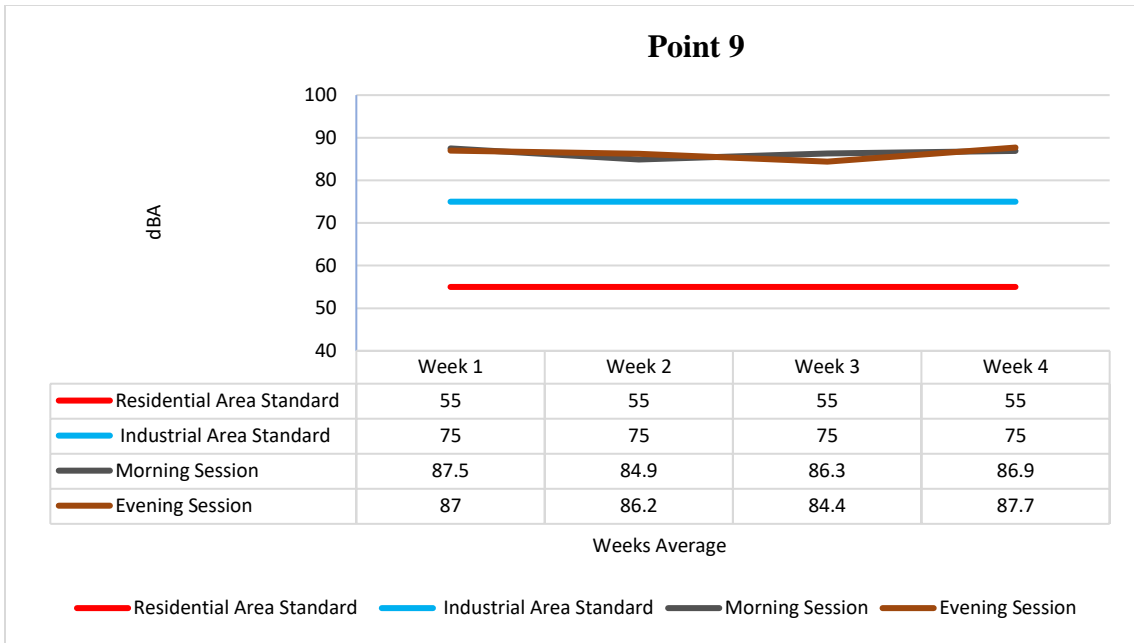


Figure 3.9: Comparison of average values of weeks of point 9 with NEQS

Figure 3.9 shows that average value of traffic noise of weeks on point 9 compared with NEQS (Table 1.1). Point 9 was located between sector I-8 and I-9. Sector I-8 comprised of residential area whereas I-9 comprised of industrial area. The standard value established by Pakistan Environmental Protection Agency for residential area and industrial area are 55 dBA and 75 dBA, respectively. The average value of point 9 was compared with NEQS according to respective zones i.e. residential area and industrial area. Minimum average value on point 9 in morning session was 84.9 dBA and for evening session was 84.4 dBA. Maximum average value on point 9 in morning session was 87.5 dBA and for evening session was 87.7 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 9 with other weeks in both morning and evening sessions. All value ranges from 84.4-87.7 dBA and these values are clearly surpassing standard value of noise in residential area and industrial area i.e. 55 dBA and 75 dBA, respectively.

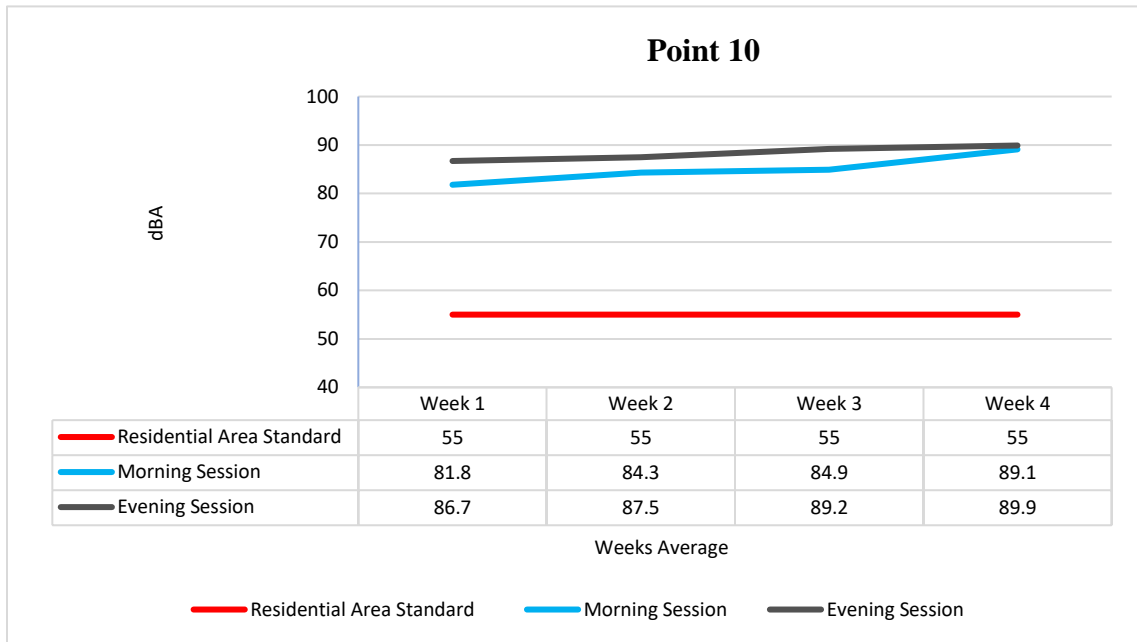


Figure 3.10: Comparison of average values of weeks of point 10 with NEQS

Figure 3.10 shows that average value of traffic noise of weeks on point 10 compared with NEQS (Table 1.1). Point 10 was located between sector I-8 and I-9. Sector I-8 and I-9 both comprised of residential area. The standard value established by Pakistan Environmental Protection Agency for residential area are 55 dBA. The average value of point 10 was compared with NEQS according to respective zones i.e. residential area. Minimum average value on point 10 in morning session was 81.8 dBA and for evening session was 86.7 dBA. Maximum average value on point 10 in morning session was 89.1 dBA and for evening session was 89.9 dBA. All values in morning and evening sessions are clearly beyond standard value.

There is variation between the average value of point 10 with other weeks in both morning and evening sessions. All value ranges from 81.8-89.9 dBA and these values are clearly surpassing standard value of noise in residential area i.e. 55 dBA.

Conclusions

After spatial and temporal analysis of traffic noise pollution of 9th avenue Islamabad, it was concluded that:

- i. Traffic noise level of 9th avenue Islamabad is exceeding the limits given by the PAK-EPA in both morning and evening session. Average value of weeks at each point, traffic noise is exceeding NEQS value according to their respective areas and zone.
- ii. Average value of residential zone for morning and evening session is 83.0 dBA and 83.6 dBA respectively however standard value for residential zone is 55 dBA.
- iii. Average value of commercial zone for morning and evening session is 83.4 dBA and 84.0 dBA respectively however standard value for commercial zone is 65 dBA.
- iv. Average value of industrial zone for morning and evening session is 86.0 dBA and 86.4 dBA respectively however standard value for industrial zone is 75 dBA.
- v. Average value of silence zone for morning and evening session is 81.6 dBA and 82.1 dBA respectively however standard value for silence zone is 50 dBA.
- vi. Traffic noise pollution poses a serious threat to human wellbeing at 9th avenue. After literature review it was concluded that people who were regularly exposed to traffic noise at 9th avenue are susceptible to many physiological and psychological issues such as hearing loss, tinnitus, hypertension, vasoconstriction, cardiovascular disorders, cancer, memory loss and other adverse effects.

The results may help to create awareness about traffic noise among residents near 9th avenue and people travelling on this route every day. The findings may assist the regulatory authorities in controlling traffic noise.

RECOMMENDATIONS

As the traffic noise level of 9th avenue, Islamabad is exceeding the standards given by Pakistan Environmental Protection Agency, following steps should be taken in order to control traffic noise level.

- 1) Grass on greenbelts should be replaced dense vegetation like evergreen shrubs and trees with broad leaves which will provides an excellent noise screen. This practice should be exercised by regulatory authority.
- 2) Noise absorbing materials should be installed by competent authority along the road to negate any harmful effects of traffic noise.
- 3) Awareness should be created by competent authority among the residents near 9th avenue and people travelling on this route every day.
- 4) Use public transport by general public instead of using their own vehicles wherever possible.
- 5) Vehicles should be maintained according to manufacturer recommendation. Owners should always follow planned preventive maintenance instead of breakdown recommendation which assist in reducing traffic noise pollution.

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Annexure

Week: 1

Date: 11-11-2019

Session: Morning

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	82.6	74.5	80.9	79.3
02	78.1	75.8	81.3	78.4
03	88.2	84.9	89.1	87.4
04	76.0	79.1	77.3	77.4
05	86.3	82.1	84.3	88.2
06	81.3	78.4	85.4	81.6
07	87.3	84.9	79.9	84.0
08	84.8	74.4	68.6	75.9
09	90.1	88.1	92.4	90.2
10	88.7	83.3	79.1	83.9

Week: 1

Date: 11-11-2019

Session: Evening

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	77.3	70.1	90.6	79.3
02	67.5	87.3	82.6	79.1
03	76.4	90.4	73.9	80.2
04	80.5	82.0	81.5	81.3
05	88.7	78.6	76.1	81.1
06	82.4	85.5	83.3	83.7
07	79.3	84.8	84.0	82.9
08	92.5	83.5	83.6	86.5
09	74.9	84.4	72.3	77.2
10	83.2	78.8	96.9	86.3

Week: 1

Date: 12-11-2019

Session: Morning

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	76.6	75.1	85.6	79.1
02	84.9	87.2	85.3	85.8
03	75.6	84.2	88.4	82.7
04	79.3	88.7	70.9	79.6
05	89.0	75.8	80.5	81.7
06	83.2	84.1	91.2	86.1
07	85.3	87.2	84.2	85.5
08	87.1	87.8	88.1	87.6
09	76.5	81.1	86.1	81.3
10	78.4	83.7	81.9	81.3

Week: 1

Date: 12-11-2019

Session: Evening

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	74.4	75.1	78.5	76
02	86.3	85.5	82.7	84.8
03	70.3	77.3	86.9	78.1
04	85.6	74.3	79.1	79.6
05	83.3	78.2	80.1	80.5
06	87.7	78.4	85.5	83.8
07	90.7	84.0	86.1	88.9
08	88.4	97.7	83.2	89.7
09	85.8	87.8	94.4	89.3
10	74.8	88.1	75.1	78.3

Week: 1

Date: 13-11-2019

Session: Morning

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	74.4	67.5	70.5	70.8
02	81.8	84.5	82.7	83.0
03	91.5	70.1	76.0	79.2
04	85.9	85.9	86.8	86.2
05	82.1	84.3	84.8	83.7
06	76.4	88.2	74.9	79.8
07	83.9	84.4	83.7	84.0
08	85.2	81.9	92.0	86.3
09	94.7	91.6	92.9	93.0
10	78.8	84.6	79.2	80.8

Week: 1

Date: 13-11-2019

Session: Evening

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	69.7	76.2	86.7	77.5
02	84.6	82.0	86.8	84.4
03	90.9	80.1	98.7	89.9
04	78.3	68.3	81.9	76.1
05	79.4	80.7	83.2	81.1
06	86.8	82.1	78.7	82.5
07	82.2	85.9	88.2	85.4
08	83.8	98.2	84.9	88.9
09	90.2	95.5	94.1	93.2
10	89.5	81.1	88.7	86.4

Week: 1

Date: 14-11-2019

Session: Morning

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	78.7	73.9	77.4	76.6
02	79.2	86.1	89.2	84.8
03	80.5	71.7	85.1	79.1
04	83.3	84.7	67.9	78.6
05	82.3	78.9	80.4	80.5
06	73.7	81.6	77.9	77.7
07	93.1	85.1	82.7	86.9
08	88.9	83.2	92.6	88.2
09	93.7	84.3	91.1	89.7
10	85.9	82.5	77.3	81.9

Week: 1

Date: 14-11-2019

Session: Evening

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	89.7	79.2	73.9	80.9
02	81.4	87.0	85.3	84.5
03	92.2	88.6	83.6	88.1
04	83.3	83.6	82.5	86.4
05	89.2	81.2	75.9	82.1
06	86.9	84.6	95.6	89.0
07	82.7	90.9	87.9	87.1
08	86.0	88.1	89.5	87.8
09	89.0	86.7	93.7	89.8
10	99.1	80.1	97.9	92.3

Week: 1

Date: 15-11-2019

Session: Morning

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	77.2	88.8	82.1	82.7
02	89.2	67.0	65.8	74.0
03	84.9	76.3	77.2	79.4
04	66.8	83.6	81.5	77.3
05	81.7	80.4	74.3	78.8
06	85.2	84.0	87.9	85.7
07	71.7	81.5	82.6	78.6
08	86.9	88.3	86.2	87.1
09	83.9	86.1	80.2	83.4
10	81.7	90.9	71.9	81.5

Week: 1

Date: 15-11-2019

Session: Evening

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	86.1	73.5	88.0	82.9
02	79.6	75.7	78.2	77.8
03	83.4	85.1	80.9	83.1
04	77.1	73.9	82.7	77.9
05	80.6	79.3	69.9	76.6
06	73.4	80.1	85.5	79.6
07	86.6	82.3	81.1	83.3
08	80.1	79.5	73.4	77.6
09	89.1	85.6	82.5	85.7
10	91.5	88.3	90.9	90.2

Week: 2

Date: 18-11-2019

Session: Morning

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	88.0	81.1	83.3	84.1
02	88.9	79.7	70.2	79.6
03	79.4	76.1	89.5	81.6
04	81.6	69.2	90.5	80.4
05	82.7	76.2	80.6	79.8
06	80.9	81.7	87.7	83.4
07	91.7	82.7	89.1	87.8
08	86.4	81.9	87.5	85.2
09	88.0	83.9	86.3	86.0
10	79.6	80.2	83.0	80.9

Week: 2

Date: 18-11-2019

Session: Evening

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	73.3	82.1	66.8	74.0
02	76.5	68.4	67.7	70.8
03	84.2	92.5	89.5	88.7
04	78.9	71.2	70.0	73.3
05	87.6	83.5	89.3	86.8
06	82.2	85.6	91.3	86.3
07	85.9	87.4	81.8	85.0
08	80.1	78.5	88.2	82.2
09	86.7	81.3	90.6	86.2
10	93.6	81.5	89.9	88.3

Week: 2

Date: 19-11-2019

Session: Morning

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	78.1	77.8	92.4	82.7
02	86.2	86.1	78.0	83.4
03	80.5	79.5	80.9	80.3
04	84.5	80.2	84.7	83.1
05	85.0	82.1	80.9	82.6
06	83.0	86.9	84.2	84.7
07	88.2	83.9	85.0	85.7
08	86.9	90.0	85.1	87.3
09	85.3	87.8	85.6	86.2
10	84.9	88.3	84.3	85.8

Week: 2

Date: 19-11-2019

Session: Evening

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	81.3	79.8	85.6	82.2
02	73.9	80.1	88.7	80.9
03	82.3	77.1	90.3	83.2
04	87.8	67.3	70.4	75.1
05	83.6	89.2	85.7	86.1
06	78.5	81.6	84.4	81.5
07	82.1	85.4	80.2	82.5
08	88.8	83.6	91.3	87.9
09	82.8	89.0	86.1	85.9
10	92.1	90.9	89.3	90.7

Week: 2

Date: 20-11-2019

Session: Morning

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	81.3	85.7	76.8	81.2
02	78.1	80.4	75.0	77.8
03	88.7	85.3	90.1	88.0
04	72.4	82.9	85.3	80.2
05	85.6	88.1	89.5	87.7
06	89.3	81.6	79.1	83.3
07	81.5	84.3	92.3	86.0
08	90.3	87.8	78.3	85.4
09	83.6	88.1	85.5	85.8
10	94.5	87.3	95.5	92.4

Week: 2

Date: 20-11-2019

Session: Evening

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	92.4	81.4	79.9	84.5
02	86.1	85.0	81.9	84.3
03	96.6	94.2	74.6	88.4
04	94.2	87.9	87.0	89.7
05	75.9	79.6	82.9	79.4
06	80.4	79.2	90.8	83.4
07	80.8	91.4	95.6	89.2
08	93.0	86.8	95.4	91.7
09	84.6	88.6	84.8	86.0
10	80.8	80.6	86.3	82.5

Week: 2

Date: 21-11-2019

Session: Morning

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	81.5	84.0	72.7	79.4
02	85.2	90.7	86.8	87.5
03	77.7	80.8	82.3	80.2
04	83.6	69.7	78.2	77.2
05	84.3	87.3	86.9	86.2
06	86.9	83.2	84.7	85.0
07	84.6	91.7	90.8	89.0
08	88.4	90.9	91.5	90.3
09	70.4	86.6	85.3	80.8
10	82.8	80.3	77.8	80.3

Week: 2

Date: 21-11-2019

Session: Evening

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	77.7	75.0	82.9	78.5
02	81.9	83.8	70.2	78.6
03	83.4	83.5	83.5	82.5
04	71.5	83.6	90.3	81.8
05	85.0	81.0	83.5	83.2
06	82.7	79.6	79.6	80.6
07	84.1	85.6	85.4	85.0
08	85.2	94.3	86.6	88.7
09	87.0	90.2	87.3	88.2
10	89.8	78.9	84.8	84.5

Week: 2

Date: 22-11-2019

Session: Morning

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	75.5	70.4	71.2	73.3
02	79.3	82.9	86.4	82.8
03	84.7	81.5	78.9	81.7
04	82.0	80.4	87.6	83.3
05	78.5	82.2	84.3	81.6
06	84.8	92.0	82.8	86.5
07	80.0	87.9	83.8	83.9
08	85.6	79.5	86.8	83.9
09	87.7	88.2	82.4	86.1
10	82.3	81.1	84.6	82.5

Week: 2

Date: 22-11-2019

Session: Evening

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	79.4	83.6	80.4	81.1
02	81.1	80.8	80.3	80.7
03	86.1	84.4	83.6	84.7
04	69.6	70.4	72.1	70.7
05	82.2	88.2	79.5	83.3
06	84.8	90.0	82.7	85.8
07	86.0	78.3	87.9	83.9
08	88.2	85.0	84.7	85.9
09	79.7	83.3	92.5	85.1
10	90.4	96.0	88.6	91.6

Week: 3

Date: 25-11-2019

Session: Morning

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	80.1	83.6	76.4	80.0
02	84.1	81.3	86.5	83.9
03	81.5	79.4	88.9	83.2
04	82.3	72.1	77.8	77.4
05	83.7	86.0	84.9	84.7
06	85.4	81.3	87.8	84.8
07	86.3	89.1	90.3	88.5
08	89.5	86.3	92.1	89.3
09	75.4	83.9	87.2	82.1
10	83.5	81.3	75.4	80.0

Week: 3

Date: 25-11-2019

Session: Evening

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	78.5	80.2	85.9	81.5
02	84.3	81.3	79.4	81.6
03	86.1	84.9	77.7	82.9
04	75.3	85.1	89.4	83.2
05	86.4	82.3	80.1	82.9
06	79.3	83.7	87.3	83.4
07	82.1	86.3	79.6	82.6
08	87.0	90.1	84.3	87.1
09	92.3	90.9	88.5	90.5
10	83.7	78.1	80.8	80.8

Week: 3

Date: 26-11-2019

Session: Morning

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	76.5	74.1	80.9	77.1
02	87.0	83.4	69.9	80.1
03	93.3	96.5	79.3	89.7
04	68.4	86.7	77.6	77.5
05	88.6	91.2	89.9	89.9
06	83.8	89.1	87.1	86.6
07	85.3	71.8	81.6	79.5
08	89.9	88.1	82.6	86.6
09	86.2	92.7	76.1	85.0
10	96.8	89.3	97.5	94.5

Week: 3

Date: 26-11-2019

Session: Evening

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	76.4	79.7	86.6	80.9
02	69.8	81.4	83.1	78.1
03	77.3	92.9	75.2	81.8
04	84.1	80.5	82.8	82.4
05	78.0	88.0	79.2	81.7
06	81.7	80.4	85.3	82.4
07	84.6	83.4	84.4	84.1
08	82.7	93.6	86.0	87.4
09	78.6	83.9	77.1	79.2
10	96.3	87.7	90.6	91.5

Week: 3

Date: 27-11-2019

Session: Morning

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	76.9	72.4	77.1	75.4
02	79.3	82.8	85.0	82.3
03	83.9	88.1	90.3	87.4
04	86.4	87.3	80.2	84.6
05	81.8	83.6	85.9	83.7
06	79.3	76.8	80.7	78.9
07	86.1	84.9	87.3	86.1
08	88.3	78.7	83.1	83.3
09	88.9	90.1	89.3	89.4
10	80.2	77.5	86.9	81.5

Week: 3

Date: 27-11-2019

Session: Evening

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	85.1	75.3	76.5	78.9
02	83.9	87.6	73.1	81.5
03	89.0	94.7	85.7	89.8
04	74.7	71.6	79.3	75.2
05	83.3	83.1	85.3	83.9
06	81.2	88.0	87.9	85.7
07	91.9	78.1	85.5	85.1
08	89.5	85.3	83.4	86.0
09	92.7	69.9	87.1	83.2
10	94.1	92.6	96.3	94.3

Week: 3

Date: 28-11-2019

Session: Morning

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	81.3	76.5	79.3	79.0
02	77.8	80.9	84.5	81.6
03	84.1	85.3	82.1	83.8
04	73.5	80.1	83.3	78.9
05	88.3	84.6	80.8	84.5
06	80.7	78.1	82.3	80.3
07	69.3	75.4	83.0	75.9
08	84.4	82.5	88.9	85.9
09	87.1	96.3	82.5	88.6
10	88.8	80.1	83.1	84.0

Week: 3

Date: 28-11-2019

Session: Evening

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	74.6	80.6	78.3	77.8
02	79.8	79.4	84.1	84.1
03	86.4	83.7	89.4	86.5
04	77.9	78.5	81.7	79.3
05	86.1	82.8	87.2	85.3
06	82.4	83.9	81.0	82.4
07	90.8	88.6	86.8	88.7
08	83.7	89.6	96.5	89.9
09	79.4	81.3	84.2	81.6
10	87.3	93.1	98.0	92.8

Week: 3

Date: 29-11-2019

Session: Morning

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	75.2	82.3	78.9	78.8
02	85.8	79.4	81.5	82.2
03	73.0	84.3	77.1	78.1
04	71.3	68.9	80.2	73.3
05	82.7	85.1	79.4	82.4
06	86.7	83.2	83.9	84.6
07	79.5	76.2	81.0	78.9
08	85.1	87.8	83.7	85.5
09	88.9	80.6	80.6	86.8
10	83.7	80.3	90.9	84.9

Week: 3

Date: 29-11-2019

Session: Evening

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	81.5	78.3	74.1	77.9
02	79.9	83.1	80.7	81.2
03	85.5	82.9	78.4	82.2
04	81.2	75.7	86.5	81.1
05	85.9	82.3	84.8	84.3
06	82.5	90.1	86.9	86.5
07	78.9	83.3	84.8	82.3
08	86.1	80.7	79.0	81.9
09	88.9	82.3	91.7	87.6
10	90.2	86.3	84.4	86.9

Week: 4

Date: 2-12-2019

Session: Morning

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	82.1	78.3	80.7	80.3
02	79.0	75.2	83.1	79.1
03	82.5	81.1	86.9	83.5
04	69.2	84.3	84.0	79.2
05	87.3	85.2	82.8	85.1
06	85.6	87.2	80.5	84.4
07	88.1	86.4	78.4	84.3
08	85.7	87.3	90.1	87.7
09	83.2	92.9	86.3	87.4
10	88.1	80.2	89.6	85.9

Week: 4

Date: 2-12-2019

Session: Evening

Day: Monday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	79.5	86.2	78.3	81.3
02	80.9	82.5	77.4	80.2
03	85.2	83.1	90.7	86.3
04	78.8	82.9	86.3	82.6
05	87.9	86.3	84.2	86.1
06	80.0	88.1	84.4	84.3
07	87.5	77.3	83.6	83.1
08	85.2	89.3	88.4	87.6
09	86.1	92.3	89.8	89.4
10	87.4	91.3	95.5	91.4

Week: 4

Date: 3-12-2019

Session: Morning

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	78.6	84.2	77.5	80.1
02	64.1	78.8	73.7	72.2
03	87.0	84.7	81.4	84.3
04	76.6	76.6	71.8	75.8
05	83.5	85.9	90.8	86.7
06	87.4	78.3	80.1	81.9
07	92.7	75.8	84.7	84.4
08	89.3	83.2	88.1	86.8
09	82.1	81.4	85.3	82.9
10	88.2	81.2	98.7	89.3

Week: 4

Date: 3-12-2019

Session: Evening

Day: Tuesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	76.3	72.9	77.3	75.5
02	67.4	69.7	82.1	73.0
03	80.9	76.5	85.8	81.0
04	83.0	83.6	81.7	82.7
05	85.1	84.5	85.4	85.0
06	81.9	89.2	89.7	86.9
07	77.6	74.4	72.9	74.9
08	93.4	87.0	94.6	91.6
09	87.5	83.7	75.2	82.1
10	95.1	86.8	88.6	90.1

Week: 4

Date: 4-12-2019

Session: Morning

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	77.9	79.2	83.5	80.2
02	82.8	77.1	86.5	82.1
03	85.7	83.0	86.4	85.0
04	76.1	80.3	78.4	78.2
05	83.5	81.2	88.7	84.4
06	84.3	82.9	86.3	85.5
07	81.6	79.2	83.8	81.5
08	86.1	88.5	80.3	84.9
09	90.1	84.3	86.0	86.8
10	81.2	91.5	88.2	86.9

Week: 4

Date: 4-12-2019

Session: Evening

Day: Wednesday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	81.2	84.1	78.2	81.1
02	80.9	83.1	86.8	83.6
03	87.3	82.0	85.1	84.8
04	87.9	83.4	90.1	87.1
05	80.1	84.9	89.3	84.7
06	86.7	83.8	78.8	83.1
07	86.2	88.5	80.9	85.2
08	92.5	80.3	86.2	86.3
09	90.1	86.2	96.2	90.8
10	92.3	87.1	90.4	89.9

Week: 4

Date: 5-12-2019

Session: Morning

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	89.2	83.9	80.2	84.4
02	76.8	78.8	84.5	80.0
03	83.2	81.5	86.2	83.6
04	82.9	85.1	87.8	85.2
05	79.2	86.5	82.1	82.6
06	81.6	83.8	76.3	80.5
07	81.3	87.2	86.7	85.0
08	88.5	82.7	80.6	83.9
09	85.9	91.2	89.4	88.8
10	84.2	92.9	90.2	90.1

Week: 4

Date: 5-12-2019

Session: Evening

Day: Thursday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	76.5	82.4	80.3	79.7
02	85.3	89.6	74.6	83.1
03	84.4	88.2	87.1	86.5
04	73.9	85.6	78.4	79.3
05	86.8	79.8	87.9	84.8
06	87.2	83.3	78.2	82.9
07	81.8	84.7	86.3	84.2
08	86.0	89.1	88.5	84.8
09	93.3	88.0	83.7	88.3
10	92.4	86.5	88.4	89.1

Week: 4

Date: 6-12-2019

Session: Morning

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	85.4	76.6	83.7	81.9
02	81.5	88.3	69.8	79.8
03	89.4	87.0	88.6	88.3
04	86.7	73.2	79.1	79.6
05	80.3	84.5	75.9	80.2
06	83.1	74.8	84.5	80.8
07	82.3	81.4	82.4	82.0
08	88.4	73.5	86.6	82.8
09	91.3	81.8	94.2	89.1
10	93.0	92.5	95.6	93.7

Week: 4

Date: 6-12-2019

Session: Evening

Day: Friday

Points	Reading 1 (dBA)	Reading 2 (dBA)	Reading 3 (dBA)	Average (dBA)
01	70.3	75.8	73.6	73.2
02	83.2	87.1	86.0	85.4
03	96.0	81.5	97.8	91.7
04	73.4	67.8	89.1	76.7
05	87.3	82.1	91.7	87.0
06	81.2	77.8	89.4	82.8
07	82.3	86.6	84.0	84.3
08	95.5	75.8	82.3	84.5
09	88.7	90.5	85.8	88.3
10	85.9	94.0	87.8	89.2