

Preliminary Survey Of Noise Levels At Major Traffic Hot-Spots In Owerri, Imo State Nigeria

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Abstract—Evaluation and analysis of noise pollution levels at some major traffic hotspots in Owerri metropolis was carried out in the month of July, 2018 to determine whether the noise generated exceeded acceptable limits by NESREA and OSHA standards and their implications on humans and the environment. The field study was carried out according to standard set by Federal Ministry of Environment and WHO. Noise level measurements were taken at some traffic hotspots such as MCC junction, Control Junction and Okigwe Road Junction using Sound level meter and the data analyzed statistically. Among the 3 junctions surveyed, Okigwe road junction was the highest with the mean maximum noise level of 77.92 dB followed by MCC junction with the mean maximum noise level of 77.1 dB. This investigation revealed that noise levels at Okigwe road junction, MCC and Control junctions did not exceed the regulatory standard limits of 88 dB by OSHA but approached the maximum of 78 by National Environmental (noise standards and control) regulations 2009 for 9 and 10 hours. However, the present status of noise pollution in Owerri Municipal poses a severe health risk to the residents. Proper regulations should be put in place by both state and local government environmental protection agencies to reduce noise pollution in Owerri metropolis for improved health of the inhabitants and cleaner environment.

Keywords—Noise, pollution, Owerri, environment, level, vehicle

INTRODUCTION

Noise pollution, a by-product of urbanization and industrialization, is globally recognized as a major problem for the quality of life in urban areas. The increase in the population and in the number of vehicles has led to an increase in noise pollution [1], and involves direct, as well as cumulative, adverse health effects ranging from annoyance to difficulty in sleep and high blood pressure [2][3]. It also adversely affects future generations and has sociocultural, aesthetic, and economic effects [4]. In urban areas, other sources of noise pollution include neighborhood electrical appliances, television and music systems, public address systems, railway and air traffic, and

generating sets [5]. Similarly, [6] stated that the source of most outdoor noise worldwide is mainly caused by machines and transportation systems, motor vehicle engines, aircraft, and trains.

The need for studies regarding urban noise pollution and its consequences on the environment has motivated various researchers on the problem in several countries [7]; [8]; [9]; [2]. Many researchers have reported that road traffic is the predominant and most generalized noise source in urban areas [10]; [11]; [12]. Vehicular noise constitutes the major form of road traffic noise, which includes engine exhaust systems, tyres interacting with the road, horns, aerodynamic friction and the interaction between vehicles, sounds of cooling fans, gear boxes and brakes among others. Road traffic noise is severe in rapidly expanding cities, in southeastern Nigeria such as Owerri, where insufficient control is exercised and cities are poorly planned [13].

The noise pollution situation in traffic hotspots in Owerri municipal is similar to that in many urban areas. The city is relatively large, having rapid increase in population growth rate and influx of vehicles. The city has expanded continuously in all directions in recent times. Many significant changes have been experienced in terms of urbanization, industrialization, expansion of road network, and infrastructure. The city has been subjected to persistent road traffic and commercial activities due to overall increase in prosperity, fast development, and expansion of the economy.

STUDY AREA

Owerri has a population of 127,213 according to the 2006 census. It is the entertainment capital of Nigeria because of its high density of spacious hotels, high numbers of street casinos, production studios and high quality centers of relaxation. It is also the trade center for palm products, corn, yams and cassava. Population increase and commercial activities in Owerri municipal attract different types of vehicles moving in and out of the city. It lies within latitudes 4.45°N and 7.15°N, and longitude 6.50°E and 7.25°E. It is the capital of Imo state and occupies the area between the lower River Niger and the upper and middle Imo River (Fig.1).

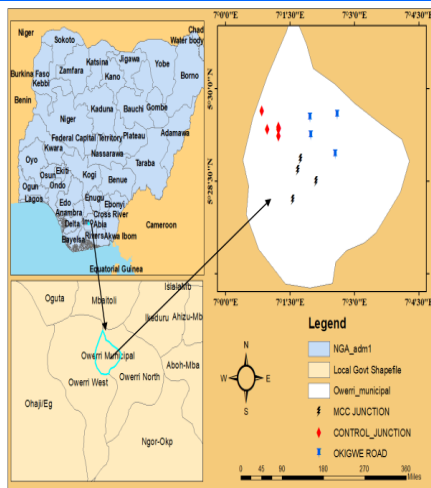


Fig.1 Map of the study area

Imo State is bounded on the east by Abia State and on the north by Anambra State, while Rivers State lies to the south. Imo State covers an area of about 5,100sq km. With an altitude of about 300m and above, soils of the area are derived from false bedded sandstones (Ajali Formation) of the Maastrichtian geologic era and proximal to the upper coal measures of the Danvan geologic era.

The level of noise emanating from vehicular movements in Owerri has assumed a worrisome dimension as a result of influx of vehicles, and is capable of disrupting or diminishing one's quality of life [14]. According to [15], both the amount of noise and the length of time one is exposed to noise determine its ability to damage hearing; hearing loss often occurs gradually, becoming worse over time. The recognition of noise as a serious hazard as opposed to nuisance is a recent development and the health effects of the hazardous noise exposure are now considered to be an increasingly important public health problem [16].

Owerri is the capital of Imo state and it has been observed that noise pollution is ever increasing. Most business activities in Imo state

take place in Owerri municipal and noise plays a major role in affecting business negatively. Noise pollution can cause hypertension, high stress levels, hearing loss, sleep disturbances, [17] and vasoconstriction leading to the increased blood pressure noted above, as well as increased incidence of coronary artery disease [18]

MATERIALS AND METHODS

The research commenced with a reconnaissance visit to the study area, Owerri municipal in Imo state, Nigeria. Three major traffic hotspots (*MCC*, *Okigwe* road and *Control* Junctions) were selected and the choice of the equipment to be used was made and establishment of stations with their coordinates taken.

MCC Junction is along *Wethral* road which links some major transport routes such as *Aba* road. There is to and fro vehicular movement and commercial activities at this section as many business offices are located along the road.

Okigwe Road Junction is the major junction leading to *Okigwe* town in Imo state, Government House, Bank Road and *Wethral* road. Commercial activities also take place along this place as business offices and hotels are located along the road.

Control Junction is the major junction in Owerri municipal and is a confluence for vehicles from Port Harcourt, Onitsha, and Lagos. Commercial activities increase as intercity shuttle buses have their base at this station.

Four stations at each major traffic hotspot with their coordinates (*MCC*, *Okigwe* road and *Control* junctions) were randomly selected for the measurement of the noise level, namely station A, B, C and D (Table 1).

Table1. Showing sampling stations and their co-ordinates

Locations	Stations	Coordinates	
		Latitude	Longitude
MCC Junction	A	5.48618 N5'29'10.55112	7.03974 E7'2'23.0874
	B	5.48602 N5'29'9.7098	7.02115 E7'113.46301
	C	5.48619 N5'29'10.55112	7.03962 E7'2'21.08561
	D	5.42707 N5'27'78.0482	7.03964 E7'2'212.14531
Okigwe Road Junction	A	5.48233 N5'27'43.65057	7.04251 E7'147.55231
	B	5.4922 N5'29'32.89007	7.03259 E7'1'56.2357
	C	5.49293 N5'29'34.68534	7.04321 E7'1'33.89529
	D	5.48734 N5'27'53.65736	7.03298 E7'1'55.87823
Control Junction	A	5.47233 N5'29'2123354	7.03015 E7'11'3.46301
	B	5.43634 N5'27'3251	7.02115 E7'113.46301
	C	5.42711 N5'76'41.54031	7.01132 E7'4'21.51364
	D	5.48943 N5'29'218815	7.02058 E7'114.16346

In this study, measurements were taken by a digital sound level meter, RISEPRO. This digital sound meter is a portable, easy to use and handy instrument for noise level measurement, monitoring and control in offices, homes, schools, traffic, audio system and construction sites. It is widely applicable for personal, business, industrial studies, with accuracy measuring ranges from 40 - 130 dB and frequency range from 31.5 to 4khz.



Plate 1: showing Sound level meter (RISEPRO)

Digital sound level meter (RISEPRO) has this following features:

1. Electret condenser microphone
2. Digital LCD display
3. Power switch
4. Maximum value hold switch
5. Level range control switch
6. Frequency weighting select switch
7. External DC power supply terminal
8. Battery door.

RESULTS

Table 2 shows the actual noise, maximum noise and minimum noise levels of the 4 stations at MCC junction for 10 days of study. The actual noise level range value for the 10 days was 67.4 – 74.8 dB. The maximum noise level ranged from 69.9 to 84.5 dB. The minimum noise level ranged from 65.4 to 72.6 dB.

Table 2.Noise levels for daily measurements at four stations in MCC Junction

Days	Stations	Actual Noise (dB)	Maximum Noise (dB)	Minimum Noise (dB)
1	A	69.8	75.4	65.5
	B	69.9	71.7	67.2
	C	74.8	79.8	72.6
	D	69.4	70.4	66.9
2	A	67.4	73.9	64.3
	B	68.4	71.1	66.6
	C	74.5	84.5	69.7
	D	68.4	69.9	67.7
3	A	74.5	84.5	69.7
	B	73.5	75.2	69.3
	C	68.4	73.2	65.7
	D	70.7	75.5	69.2
4	A	69.9	73.4	66.5
	B	69.3	72.4	67.4
	C	69.6	73.4	66.5
	D	70.1	73.4	68.5
5	A	69.3	70.5	67.9
	B	69.7	72.3	66.5
	C	72.1	75.4	69.5
	D	70.3	73.5	68.7
6	A	68.5	70.6	66.5
	B	69.5	72.4	67.2
	C	70.5	73.2	68.5
	D	68.7	72.5	65.4
7	A	69.7	73.5	67.2
	B	68.6	72.4	66.5

	C	69.5	72.5	66.7
	D	69.3	73.1	66.5
8	A	69.5	72.3	66.4
	B	68.7	70.5	64.5
	C	70.1	74.5	68.7
	D	71.3	75.4	69.5
9	A	68.6	71.3	66.7
	B	69.5	73.5	67.4
	C	70.1	75.7	69.4
	D	68.7	72.3	66.5
10	A	69.6	72.3	66.7
	B	68.9	71.0	66.5
	C	70.1	73.5	69.4
	D	69.7	73.4	68.5

Table 3 showed the actual noise, maximum noise and minimum noise levels of the 4 stations at *Okigwe* Road junction for 10 days of study. The actual noise

level for the 10 days ranged from 68.4 to 76.3 dB. The maximum noise level ranged from 69.7 to 84.5 dB. The minimum noise level ranged from 66.3 to 70.5 dB.

Table 3. Noise levels for daily measurement at four stations in *Okigwe* Road Junction

Days	Stations	Actual Noise (dB)	Maximum Noise (dB)	Minimum Noise (dB)
1	A	71.9	74.5	66.3
	B	70.6	79.4	69.7
	C	70.4	78.1	68.2
	D	68.7	69.7	65.8
2	A	74.5	84.5	69.7
	B	70.5	77.8	69.9
	C	69.9	76.2	67.3
	D	68.4	73.2	66.5
3	A	75.7	79.5	70.2
	B	76.3	79.4	69.5
	C	71.3	76.6	67.9
	D	69.8	72.3	66.5
4	A	70.6	79.4	69.7
	B	70.5	78.1	68.2
	C	69.4	73.4	66.7
	D	70.1	72.4	69.4
5	A	70.3	75.4	68.7
	B	71.0	75.7	69.2
	C	71.9	74.5	68.2
	D	69.8	72.5	66.7
6	A	70.6	77.7	68.5
	B	71.2	78.7	69.5
	C	70.7	74.5	68.5
	D	72.3	77.5	69.8
7	A	72.1	78.3	69.6
	B	72.8	74.7	70.1
	C	71.2	73.6	69.4
	D	72.3	75.7	70.1
8	A	70.1	76.5	68.5

	B	71.3	77.5	69.8
	C	73.4	78.6	70.5
	D	69.5	73.5	66.4
9	A	75.4	78.9	70.1
	B	70.1	75.4	69.5
	C	71.3	76.5	68.7
	D	69.5	73.4	68.5
10	A	70.1	75.6	68.7
	B	71.3	77.6	69.4
	C	69.5	73.7	66.4
	D	72.3	77.5	68.7

Table 4 showed the actual noise, maximum noise and minimum noise levels of the 4 stations at *Control* junction for 10 days of study. The actual noise level for

the 10 days ranged from 68.4 to 72.6 dB. The maximum noise level ranged from 69.9 to 78.5 dB. The minimum noise level ranged from 65.3 to 71.4 dB.

Table 4.. Noise levels for daily measurement at four stations in *Control* Junction

Days	Stations	Actual Noise (dB)	Maximum Noise (dB)	Minimum Noise (dB)
1	A	71.3	76.6	67.9
	B	72.3	76.3	71.4
	C	72.6	73.4	68.7
	D	72.3	76.4	70.4
2	A	68.4	69.9	67.0
	B	70.4	75.9	68.3
	C	69.2	71.6	68.6
	D	70.1	77.1	68.7
3	A	70.1	73.0	67.8
	B	71.3	77.3	68.0
	C	72.3	74.7	69.1
	D	71.0	74.7	68.7
4	A	71.3	76.6	67.9
	B	70.4	73.5	68.5
	C	69.5	72.4	66.5
	D	71.2	75.7	68.6
5	A	70.6	73.4	68.7
	B	72.3	76.4	69.5
	C	70.5	75.4	67.6
	D	72.3	76.5	70.4
6	A	70.7	73.2	66.8
	B	72.3	76.5	68.4
	C	71.2	77.8	68.5
	D	69.5	75.7	66.5
7	A	70.1	73.5	68.7
	B	71.3	76.5	69.5
	C	72.5	76.5	69.7
	D	69.5	73.4	67.5
8	A	70.1	74.5	68.5
	B	72.3	77.5	69.5
	C	69.5	74.3	67.6

	D	68.6	75.4	66.5
9	A	70.1	75.4	68.7
	B	69.5	73.7	65.6
	C	71.3	77.7	69.5
	D	69.6	74.5	66.5
10	A	70.1	75.4	67.5
	B	71.4	77.5	69.3
	C	69.7	76.5	65.3
	D	71.4	78.5	69.7

Table 5 shows the mean actual noise, maximum noise and minimum noise levels of *MCC* junction for 10 days of study. The highest mean actual noise level for the 10 days was 71.77 dB, while the lowest mean actual noise was observed to be 69.22 dB. The highest and lowest mean maximum noise level was 77.1 dB and 72.17 dB respectively. The lowest mean minimum noise level was 65.95 dB and the highest mean minimum noise level was 68.47 dB.

Table5. Mean Noise levels for daily measurement at *MCC* Junction

Days	Actual Noise (dB)	Maximum Noise (dB)	Minimum Noise (dB)
1	70.35	73.37	65.95
2	69.67	74.85	67.07
3	71.77	77.1	68.47
4	69.72	73.15	67.22
5	70.35	72.92	68.15
6	69.3	72.17	66.9
7	69.27	72.87	66.72
8	69.9	73.17	67.27
9	69.22	73.2	67.5
10	69.57	72.55	67.77

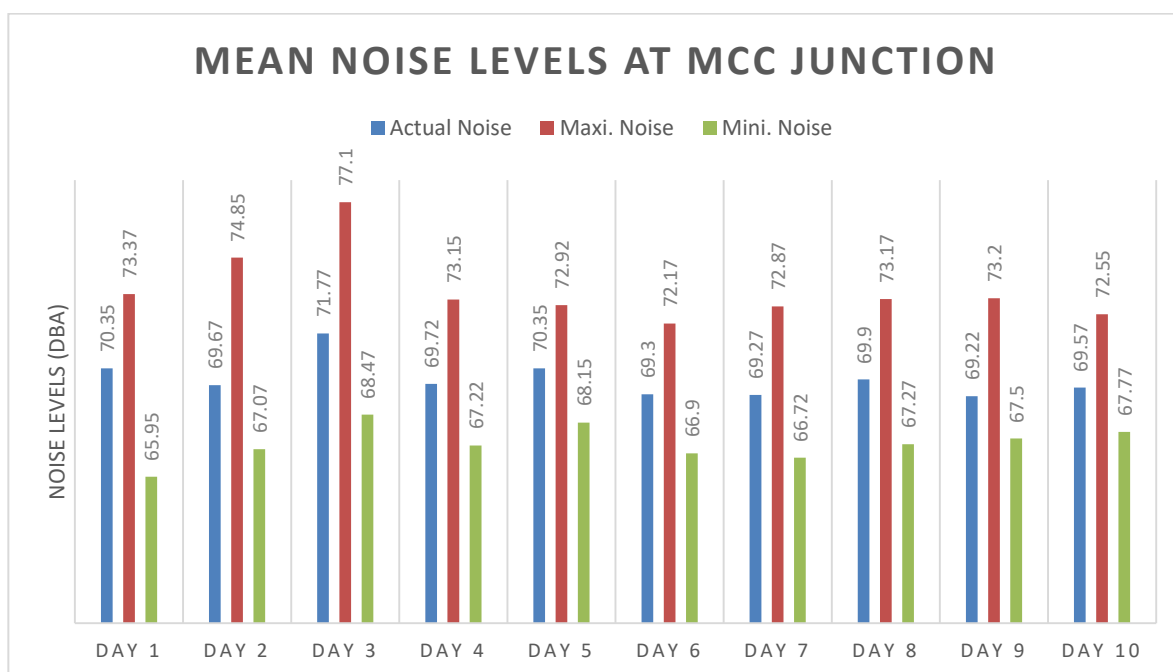


Figure 1 Graph showing Mean Noise levels at *MCC* Junction

Table 6 showed the mean actual noise, maximum noise and minimum noise levels of *Okigwe* Road Junction for the duration of the study. The highest mean actual noise level for the duration was 73.27 dB, while the lowest mean actual noise was observed to be 70.15 dB. The highest and lowest mean maximum noise levels were 77.92 dB and 75.42 dB respectively. The lowest mean minimum noise level was 67.5 dB and the highest mean minimum noise level was 69.8 dB.

Table 6. Mean Noise levels for daily measurement at Okigwe Road Junction

Days	Actual Noise (dB)	Maximum Noise (dB)	Minimum Noise (dB)
1	70.32	75.42	67.5
2	70.82	77.92	68.35
3	73.27	76.95	68.52
4	70.15	75.82	68.5
5	70.75	74.52	68.2
6	71.2	77.1	69.07
7	72.1	75.57	69.8
8	71.07	76.52	68.75
9	71.57	76.05	69.2
10	70.8	76.1	68.3

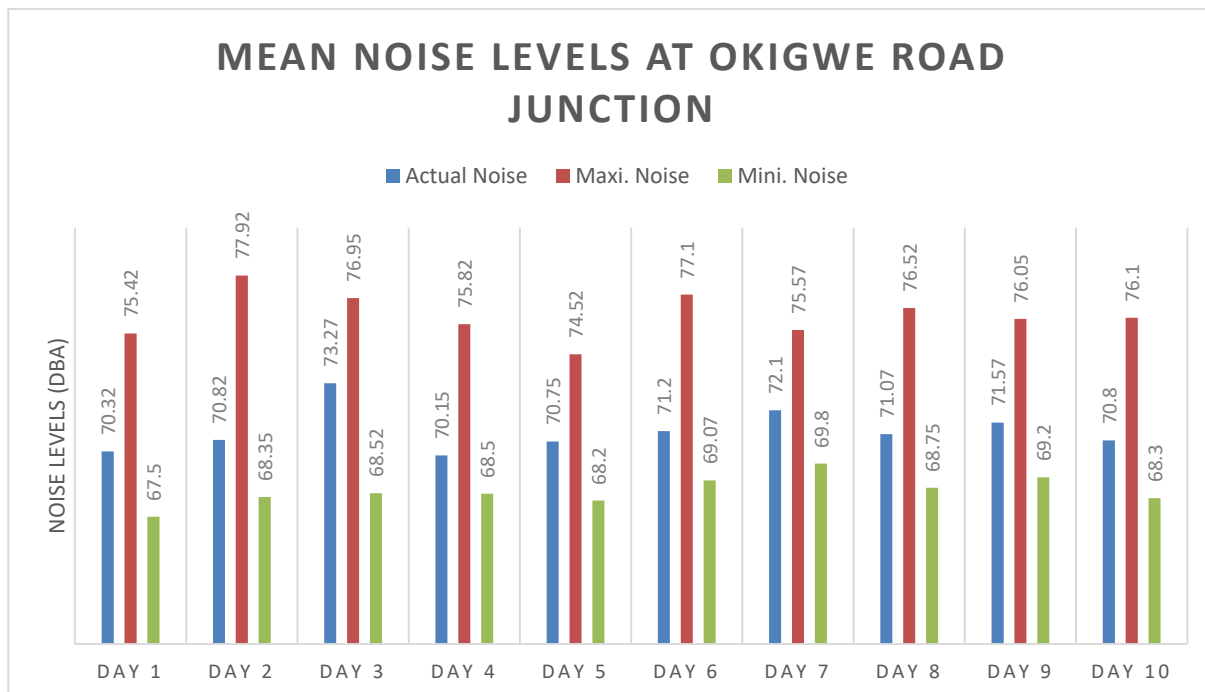


Figure 2 Graph showing Mean Noise levels at Okigwe Road Junction

Table 7, showed the mean actual noise, maximum noise and minimum noise levels of Control Junction for the duration of the study. The highest mean actual

noise level for the duration was 72.12 dB, while the lowest mean actual noise was observed to be 69.52 dB. The highest and lowest mean maximum noise level was 76.97 dB and 73.62 dB respectively. The lowest mean minimum noise level was 67.55 dB and the highest mean minimum noise level was 69.6 dB.

Table 7. Mean Noise levels for daily measurement at Control Junction

Days	Actual Noise (dB)	Maximum Noise (dB)	Minimum Noise (dB)
1	72.12	75.75	69.6
2	69.52	73.62	68.15
3	71.17	74.92	68.4
4	70.6	74.55	67.87
5	71.42	75.42	69.05
6	70.92	75.8	67.55
7	70.85	74.97	68.85
8	70.12	75.42	68.02
9	70.12	75.32	67.57
10	70.6	76.97	67.95

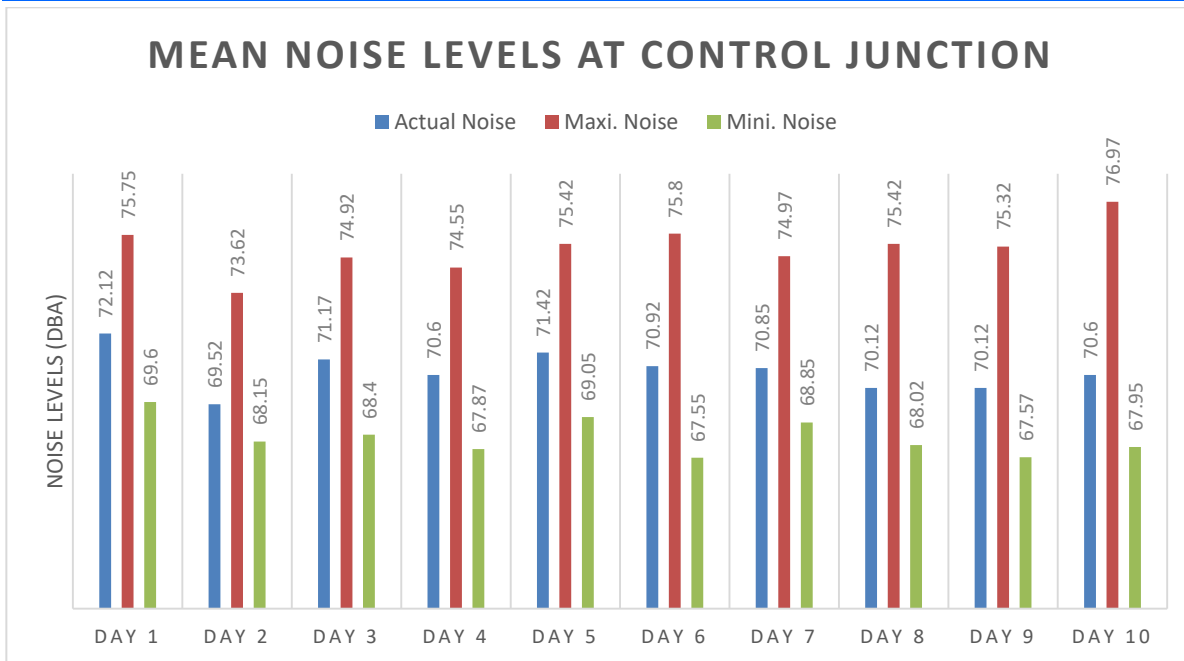


Figure 3 Graph showing Mean Noise levels at Control Junction

Table 4.7. Comparison of the actual noise mean with different regulatory standards

Locations	Maximum Noise	NESREA For 10hours	OSHA For 9hours
MCC Junction	77.1	78- 84	88
Okigwe Road junction	77.92	78- 84	88
Control Junction	76.97	78- 84	88

DISCUSSION

The global permissible noise limit for residential and small scale commercial premises ranged between 50-60 decibels during the day and 30-50 decibels at night [24]. However, many authors have observed variations in sound levels related to road traffic characteristics, and especially traffic volume, vehicle horns, rolling stock and tyres, etc. [11];[19];[1]. The high noise pollution levels in the morning at these locations can be justified by reason of morning rushing hours of office workers and business men and women, to resume work at offices and open shop for customers. Several studies have demonstrated that the urban conditions of a given area are also a very important factor influencing the environmental noise levels [12]. The numbers of vehicles that ply the roads in the study areas are very high, and of course, there is a speed limit (40 km/h) for every vehicle that passes through these junctions. Blaring of horns, holding of brakes, engines sounds, among others constitute the noise pollution in these hotspots. The highest and lowest noise pollution levels in the 3 junctions (MCC,

Okigwe Road and Control Junctions) were 77.92 dB and 65.95 dB respectively. This was less noisy compared to the peak noise value of 91.5 dB in Markurdi [2] and between 86 and 106 dB in Aba and Uyo [13].

Among the 3 junctions surveyed, Okigwe road junction had the highest noise level with value 77.92 dB, followed by MCC junction with the mean maximum noise level of 77.1 dB. This high value is attributed to the fact that there were a lot of activities at the junctions during the daytime. The volume of vehicles plying the network of roads in these junctions are coupled with business activities on daily bases This attests to the finding of [20] that most environmental noise results from road traffic and commercial activities. The Control junction recorded the least value mean maximum noise level of 76.97 dB due to free flow of traffic during days of measurement. The study revealed that these junctions were exposed to noise level exceeding the maximum allowable limit of 70 dB for predominantly commercial areas. Okigwe road junction exceeded the allowable limit set by EPA by 7.92 dB, MCC junction exceeded the allowable limit by 7.1 dB and Control junction also exceeded the allowable limit by 6.97 dB. It should be noted that noise levels of 74 dB has been reported to be associated with less than 3% annoyance in social survey [3]. The maximum noise levels from this study did not exceed the OSHA regulatory standards of 88 dB, but approached the maximum permissible noise levels of National Environmental (noise standards and control) regulations for accelerating vehicles of 78dB. In Comparison with findings from other cities around the globe; in the city of kerman, Iran, noise levels varied between 66 dB to 79.5 dB [21]; in India intermediate city, noise level was observed to be 73.2 dB [22]; in South-East, Nigeria noise level varied between 68.0 dB to 84.6 dB [23], and in Ilorin, Nigeria noise levels varied between 75 dB and 83 dB [24].

CONCLUSION AND RECOMMENDATION

This investigation revealed that noise levels at Okigwe road junction, MCC and Control junctions did not exceed the regulatory standard limits of 88 dBA by OSHA for 10 hours, but approached the maximum limit of NESREA. However, the present status of noise pollution from these traffic hotspots in Owerri Municipal poses a severe health risk to the residents. Furthermore, discomfort and irritation being caused by the pollution could drastically reduce productivity, both in public service and private sectors, and might lead to permanent loss of hearing.

It is therefore recommended, that technical actions to abate the environmental noise pollution from vehicular transportation in Owerri municipal and Nigeria at large be taken. There is need to establish environmental noise impact criteria levels for various land use purposes.

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