Original Research Article

MEASUREMENT OF TRAFFIC NOISE AND TRAFFIC VOLUME ON MAJOR JUNCTIONS ALONG EAST-WEST ROAD, PORT HARCOURT

ABSTRACT

This study investigated noise pollution level during peak and low traffic hours in six junctions along East west road, Port Harcourt, Rivers State. An integrated noise level meter (MEXTECH-805) was used to measure the equivalent continuous noise level (L_{eq}) for a period of six days between 8a.m to 9a.m and 12pm to 1pm. A vehicle count done and measured with noise produced revealed low and peak traffic periods and that vehicle flow affects traffic noise. Results showed noise level during peak traffic period were all above the recommended exposure threshold for both WHO and FMEnv standard. The range in values of the L_{eq} at peak traffic were, for Eleme junction (90dB- 97.1dB), Rumuodara junction (89.2dB -96.4 dB), Eliozu junction (89.9dB - 98.8dB), Nkpolu junction (92.8dB-101dB), Choba junction (92.8Db-99.3Db) and Alakahia junction (90dB-99.6dB). However, for the low traffic period from (12pm to 1pm), the result showed a drastic reduction in the level of noise generated from traffic at later hours of the day. Eleme junction recorded an equivalent (Leq) noise level range of (60dB-70.4dB), Eliozu junction (59.9dB-70dB), Nkpolu junction (61.9dB -78.8dB), (59.8dB-70.1dB) for Choba junction and (63.2dB - 69.2dB) for Alakahia junction. Mean noise generated in all junctions during low traffic period were below the threshold level for the World Health Organization and other regulations. The mean equivalent noise level for peak traffic reveals that Eleme is the least with 64.2dB then Eliozu junction with 65.8dB followed closely by Choba junction with 65db while Nkpolu, Rumuodara and Alakahia junctions had 66dB, 66.3dB and 67dB respectively. For peak traffic, Rumuodara junction proved to have the least of noise generated at 92.1dB followed by Choba with 93.9dB and Alakahia with 94.5dB while Eliozu, Eleme, and Nkpolu junctions had the highest noise generated with 95.2dB, 95.5dB, and 96.9dB respectively.

1. INTRODUCTION

Transportation is an integral part of mankind's everyday life as people move by either land, sea or air from one place to another for different reasons. In their study, Smith et al., 2017, reported that noise created by road traffic has been linked with adverse health consequences such as hypertension and cardiovascular disease. A recent study conducted by World Health Organization (2011) reported that "one million people are losing their lives every year due to traffic noise in western Europe alone which goes to prove the severity and necessity of mitigating the traffic noise from every delicate corner possible(Kamineni et al., 2019). Noise production is one of the contaminants that impact the atmosphere around the world. It can be characterized as noise propagation with a detrimental effect on the physiological and psychological lives of humans or animals (Oguntunde et al., 2019). Arokoyu et al (2016)

also defined vehicle noise pollution as the cumulative sound energy that can consist of road surface and tire friction, engine/transmission, aerodynamic, and braking components originating from motor vehicles Given the harmful impacts of pollution from noise, lack of awareness for many people has claimed the responsibility while many people are victims to noise pollution hazards in Nigeria(Adeke et al., 2018)

The increase in human population with corresponding increase in traffic volume and the boost in socioeconomic activities in Nigerian cities heightens the level of noise pollution in the cities. According to Qin et al (2019), The rapid growth of urbanization has led to numerous urban problems including traffic congestion, pollution, poverty, crime, and waste management Traffic noise has been identified as A big cause in urban areas of noise emissions. Omidvari & Nouri (2009) mentioned that in large cities, traffic can be regarded as the primary source of noise pollution. It is fair to say that road traffic noise is the most critical source in urban cities since airports are typically situated outside the city centers and trains are usually built to travel out of the city center and seldom cross the residential districts (Maghrour Zefreh & Torok, 2018). It can be characterized as the spread of noise that affects the physiological and psychological lives of humans or animals with a harmful effect. Compared with other sources of emissions such as air, water, soil, light and radioactive pollution, noise or sound pollution is typically not studied. The explanation is that the negative impact on humans of other types of pollution are more pronounced. This has led the World Health Organization (WHO) and the Federal Environment Ministry (FMEnv) to set guidelines and limitations for acceptable noise levels in Nigeria. Noise emission happens where certain standards are found to be exceeded.

Hearing loss or disability is the most common manifestation of noise pollution (Oguntunde et al., 2019) In comparison with other pollutants, environmental noise regulation has been hindered by inadequate understanding of its impact on humans and dose-response relationships, as well as by a lack of adequate evidence, particularly in developing countries such as Nigeria (Oyedepo & Saadu, 2010). From multiple viewpoints, noise emission monitoring was considered, while some argued that it should be a government program, some thought that the testing should be carried out according to the individual's financial power (Nwabuogo & AO, 2017).

The noise generated during peak traffic is expectedly higher than after. Bhosale et al (2010) in a study found that there is a higher noise level at dense traffic zones during morning and evening sessions in urban cities and that the vehicular traffic is the significant contributor of the noise pollution in urban areas. While the increased risk of noise-induced cardiovascular disease could be negligible, it is important for public health because it tends to increase both the number of individuals at risk and the noise to which they are exposed. Children are also at risk. Increased blood pressure and increased levels of stress-induced hormones have been seen in children who live in loud environments (Jariwala et al., 2017). The idea of this research is to carry out a testing to know the sound or noise generation level hence creating a deep awareness to the government and general public so as to enable a synergy in working to improve a safer and suitable environment to live in

Noise is usually characterized by, frequency, wavelength amplitude, intensity, and periodicity. (Deepak Jhanwar, 2016). Among all the types of environmental pollution, given the least attention is noise pollution (Spence, 2016).

1.1 Frequency

`Frequency is the amount of pressure variation cycles in the medium per unit time and is usually expressed in Hertz (Hz). Sounds with certain frequencies may be more disturbing than sounds of same decibel of different frequency.

1.2 Amplitude

The number of molecules displaced by a vibration creates amplitude. In a single cycle, the amplitude of a periodic variable is a measure of its transition.

1.3 Wavelength

The wavelength is the distance traveled during a continuous period by pressure waves.

2. MATERIALS AND METHODS

2.1 RESEARCH DESIGN

Noise level study of six junctions along the east-west road Port Harcourt was done using qualitative and quantitative research design method. Qualitative and quantitative data were collected analyzed and consequently compared with relevant standards. The integrated sound level meter (MEXTECH-805) was quite instrumental in the collection of the transient noise data in the field in Leq Measurements were taking hourly for both peak and low traffic periods for 6 days duration from Monday to Friday and Monday for the last location

2.2 AREA OF THE STUDY

The EAST-WEST road is the Nigerian Federal Road connecting the south and the west. In Port Hacourt, it begins at Eleme down to Choba. The junctions pivotal for this study are however Eleme, Rumuodara, Eliozu, Nkpolu Alakahia and Choba junctions.

In Rivers State, Nigeria, Eleme is a local government district. It is part of the Metropolitan City of Port Harcourt. It occupies an area of 138 sq km and had a population of 190,884 in the 2006 Census. The Eleme junction is characterized by a flyover and one of the major hub of commercial and private vehicles leading to different locations. Eliozu, Nkpolu and, Rumuodara, Alakahia and Choba are some of the communities in the Obioakpor local government area of Port Harcourt and have their junctions located also along the EAST-WEST road OF Port Harcourt with coordinates of 4°51'33"N 7°1'18"E, 4°51'37"N 7°1'46"E, 4°49′27″N 7°2′1″E , 4°48'59.0"N 7°03'51.1"E respectively.

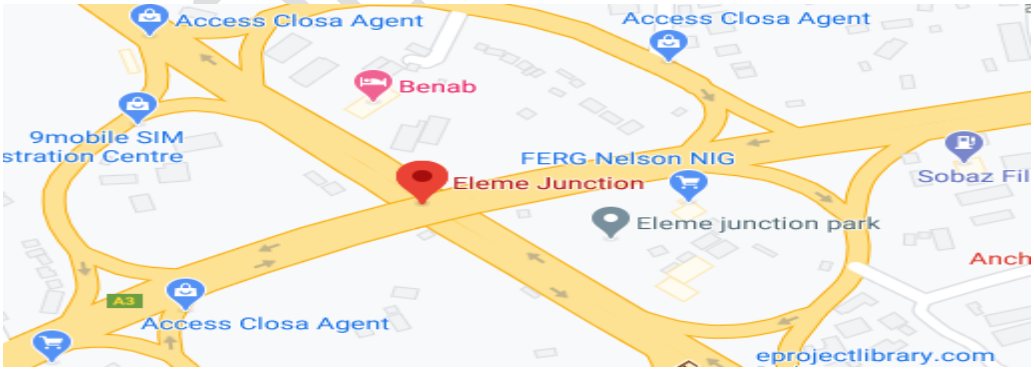

Figure 1: Map of Eleme junction

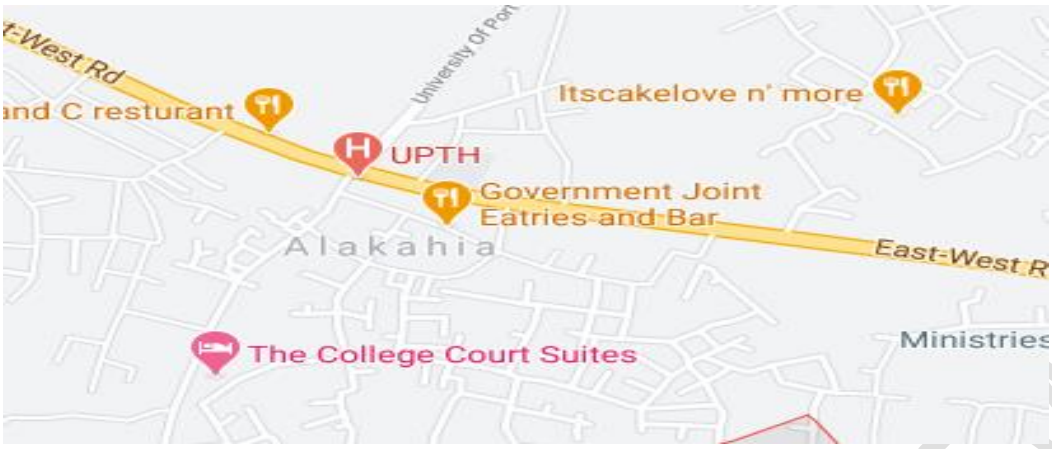

Figure 2: Map of Alakahia junction

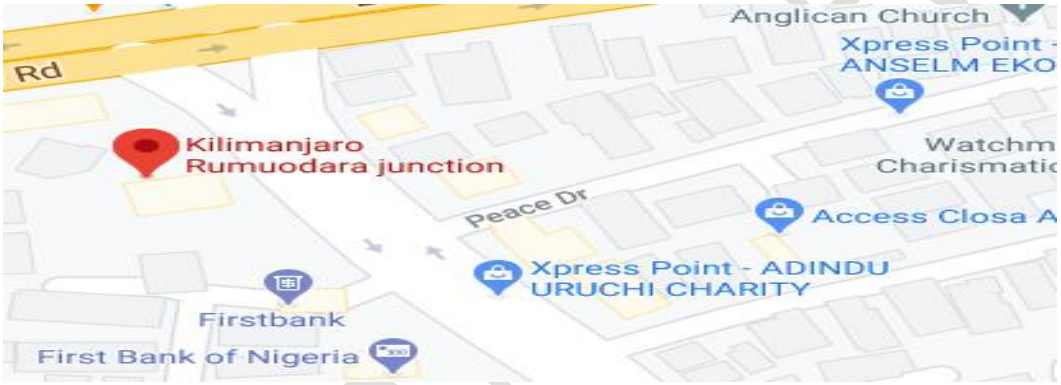

Figure.3: Map of Rumuodara junction

Figure 4: Map of Eliozu

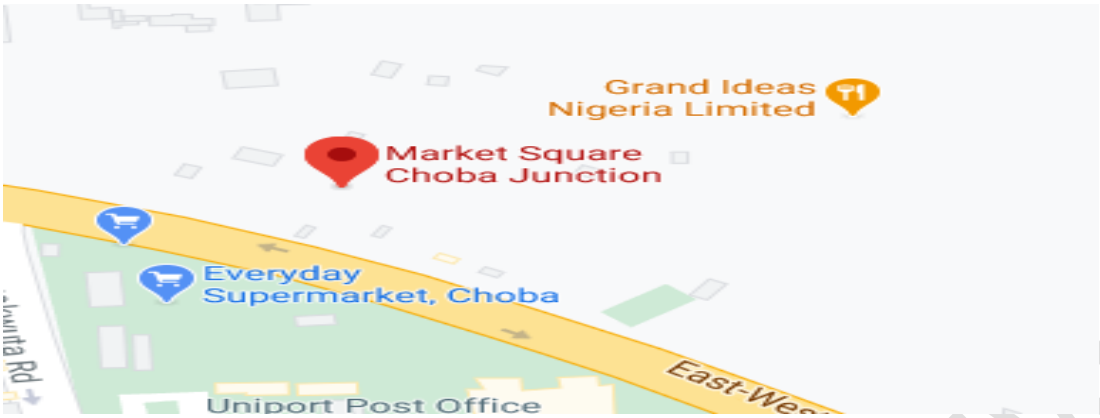

Figure.5: Map of Choba

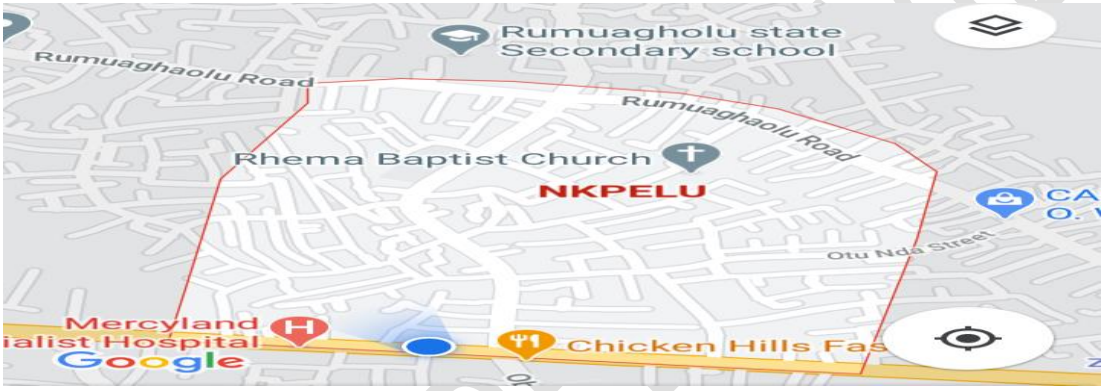

Figure.6: Map of Nkpolu

Source: google earth map

2.3 SOURCES OF DATA

Primary and secondary information were collected. On site, primary data which is the values of the equivalent continuous sound pressure level (Leq) were collected on the field using an integrated sound level meter while all other data were secondary sources from reference materials such as textbooks, journals, magazines among others

2.4 SAMPLING TECHNIQUE

The purposive or judgmental sampling method was used to pick six major junctions along the east west road of Port Harcourt. This is attributable to the recognized traffic normally faced in those areas.

2.5 METHODS OF DATA COLLECTION

To collect data from the field, normal field inspection protocols were adopted. The sound level meter (MEXTECH DT-805) was used to measure from the six locations for an hour in the morning (8am-9am) and afternoons (12pm-1pm) representing the low and peak traffic periods respectively. An average 5

minutes sample procedure was applied and with the measuring instrument placed 3-10 meters high above the ground in accordance with NSW(2000) NOISE MEASUREMENT procedure.

The monitoring was carried and 2 sets of data from the five minutes interval of an hour were collected for each six locations giving a total of 144 data to be analyzed and determine. This followed a 6 days vehicle count on all locations at peak and low traffic periods.

2.6 METHOD OF DATA ANALYSIS

The noise level obtained were compared with allowable best standards such as (*National Environmental(Noise Standards and Control) REGULATIONS 2009*, n.d.) and the WHO. Also, the significant variation of the noise generated for peak and low traffic period across all locations were determined using the statistical software for social scientists (SPSS IBM 20).

3. RESULTS AND DISCUSSION

3.1 RESULT

A total of six junctions along the East west road Port Harcourt were assessed for their noise level during peak traffic and low traffic and a significance test using the SPSS package was carried out to determine the variation in noise level for both periods across all junctions and the results are presented in tables 1-3 and figure 7 below.

Table 1: Peak traffic data (Leq) (dB)

S/N	TIME (A.M)	ELEME	RUMUODARA	ELIOZU	NKPOLU	CHOBA	ALAKAHIA
1	8:00-9:05	97.1	89.2	94.1	101.0	95.0	99.6
2	8:06-9:11	97.0	90.7	89.9	99.0	87.0	98.1
3	8:12-9:17	98.1	92.1	95.6	94.7	90.1	89.9
4	8:18-9:23	96.3	94.0	90.0	96.8	94.3	90.0
5	8:24-9:29	95.4	90.0	95.8	97.7	89.6	95.3
6	8:30-9:35	90.0	93.1	96.7	98.2	92.8	97.7
7	8:36-9:41	99.5	89.0	95.7	95.9	94.2	93.1
8	8:42-9:47	98.2	95.0	96.8	96.6	93.2	94.1

9	8:48-9:53	96.4	96.4	98.8	95.4	96.1	96.0
10	8:54-9:59	89.8	93.2	98.5	98.3	97.3	96.2
11	8:00-9:05	93.5	91.6	97.1	92.8	98.2	92.5
12	9:06-10:11	95.0	91.5	93.5	96.4	99.3	91.0

S/N	TIME (P.M)	ELEME	RUMUODARA	ELIOZU	NKPOLU	CHOBA	ALAKAHIA
1	12:00-12:05	65.7	59.6	70.0	74.2	69.0	67.0
2	12:06-12:11	64.1	65.4	69.0	66.0	52.9	68.0
3	12:12-12:17	70.4	70.1	69.8	61.9	59.5	69.2
4	12:18-12:23	63.2	67.0	72.1	64.4	66.5	66.5
5	12:24-12:29	60.0	67.0	63.6	63.8	63.4	64.9
6	12:30-12:35	61.4	68.2	59.9	64.9	70.1	65.5
7	12:36-12:41	63.3	66.4	60.4	67.0	67.1	67.4
8	12:42-12:47	65.0	64.3	65.5	67.7	62.7	63.2
9	12:48-12:53	62.0	66.6	66.6	63.2	68.8	67.3
10	12:54-12:59	66.1	67.4	67.8	68.0	67.1	69.1

11	1:00-1:05	64.2	68.5	61.2	68.3	66.8	68.2
12	1:06-1:11	65.0	62.0	63.4	65.7	67.1	68.4

Table 2: Low traffic data (Leq) (dB)

Table.3: mean equivalent noise level for peak and low traffic periods

	ELEME	RUMUODARA	ELIOZU	NKPOLU	ALAKAHIA	CHOBA
PEAK TRAFFIC	95.5	92.1	95.2	96.9	93.9	94.5
LOW TRAFFIC	64.2	66	65.8	66.3	65	67

Table4: vehicle flow per hour from 8-9 a.m

`S/N	PEAK TRAFFIC	ELEME	RUMUODARA	ELIOZU	NKPOLU	ALAKAHIA	CHOBA
1	Lane 1	2010	1985	1850	2081	2015	1800
2	Lane 2	2055	1800	2100	2000	1720	2100
3	TOTAL	4065	3785	3950	4081	3735	3900

Table5: vehicle flow per hour from 12-1 p.m

S/N	LOW TRAFFIC	ELEME	RUMUODARA	ELIOZU	NKPOLU	ALAKAHIA	CHOBA
1	Lane 1	752	1000	1000	957	820	1560
2	Lane 2	1000	1050	1021	1115	946	1200
3	TOTAL	1752	2050	2021	2072	1766	2760

Table.6: Analysis of variance for peak traffic periods on all locations

Noiselevel

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	155.284	5	31.057	3.623	.006
Within Groups	565.713	66	8.571		
Total	720.998	71			

Table.7: Analysis of variance for low traffic period on all junctions

noise levels of locations

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58.799	5	11.760	1.016	.416
Within Groups	764.133	66	11.578		
Total	822.933	71			

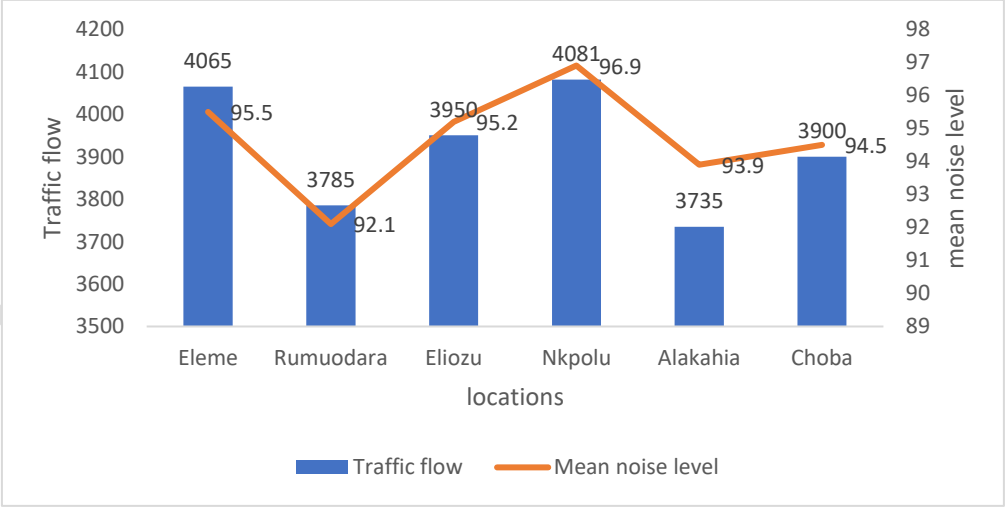

Figure 7: Mean representation of traffic flow and noise level for peak traffic period

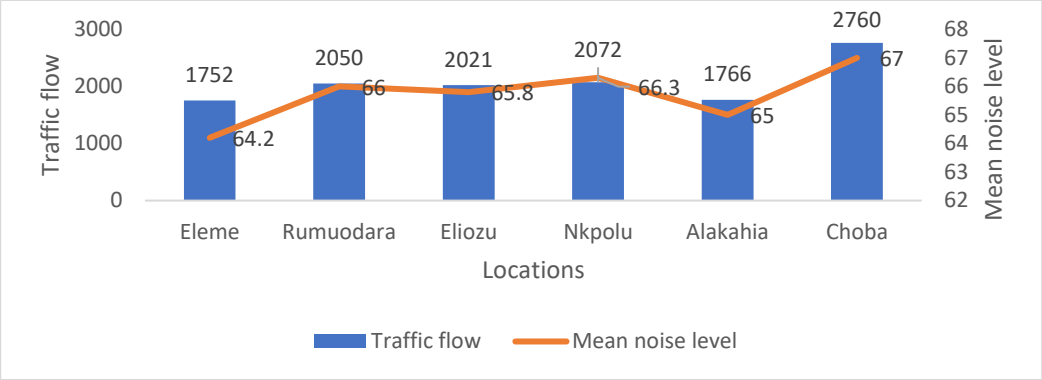

Figure 8: Mean representation of traffic flow and noise level for low traffic period

3.2 DISCUSSION OF RESULTS

The noise level as shown for peak traffic in table.1 and emphasized in the mean traffic noise in 4.3 describes that the noise generated during peak traffic period is way higher than noise generated during low traffic period. Also, as compared with the World Health Organization and even NESREA standards of 85dB and 70dB for noise exposure limit, noise generated during peak traffic period is beyond the threshold. In the mornings from 7a.m to 10a.m is usually a high traffic period and junctions are usually congested hence the level of noise generated with Eleme junction having a noise level ranging from 90dB to 97.1dB, Rumuodara ranging from 89.2dB to 96.4 dB, Eliozu junction from 89.9dB t0 98.8dB, Nkpolu junction from 92.8dB to 101dB, Choba junction from 92.8dB to 99.3dB and Alakahia from 90dB to 99.6dB.

On the other hand, for the low traffic period, the result as shown in table 2 reveals that there is really a drastic reduction in the level of noise generated from traffic at later hours of the day. Contrary to the previous results from table 1, Eleme junction recorded an equivalent (Leq) noise level ranging from 60dB to 70.4dB, Eliozu junction recorded a range from 59.9dB to 70dB Nkpolu junction from 61.9dB to 78.8dB, 59.8dB to 70.1dB for Choba junction and 63.2dB to 69.2dB for Alakahia junction. This is really encouraging level of noise generated as all junctions during low traffic period generated noise below the threshold level for the World Health Organization and other regulations. Traffic flow results gotten from each junction shows a higher flow of vehicles in the mornings as more vehicles passed by each junctions in one hour in the mornings than there was in the afternoon periods of 12-1 pm. Table 4 clearly shows Nkpolu junction to have the highest number of vehicles pass in 1hour with a total number of 4085 from both lanes followed by Eleme junction with 4,065 vehicles then Eliozu, Choba Rumuodara and Alakahia having 3950, 3785, and 3735 respectively. On the other hand, the afternoon period of 12-1pm shows that tChoba junction has the highest traffic volume with 2760 vehicles per hour and Nkpolu, Rumuodara, Eliozu, Alakahia, and Eleme have 2072, 2050, 2021, 1766 and 1752 respectively. This measured wit noise generated agrees with that the higher the traffic flow, the higher the noise generated as demonstrated in figures 7 and 8.

An analysis variance test was done to determine the significance in the variation of noise generated across all junctions. As seen in tables 3 and.4. Table.3 is the result for traffic peak hours showing a significant value or a P-value of 0.006 which is a value lower than the 0.05 hence the null hypothesis is failed not to be rejected and the alternative hence accepted thus the conclusion that there is significant variation in noise generated during peak traffic hours in all six locations. This case is different for low traffic periods as the significant value is 0.416 which is seriously above 0.05 and such the null hypothesis is failed not to be accepted and the alternative hypothesis rejected, and the conclusion is that there is no significant difference in the noise generated at low traffic periods in all junctions

4. CONCLUSION

The Leq gives information on the continuous noise level over a given period in time and used to assess the noise at the six locations for peak and low traffic periods, information got revealed a huge violation of standards of the WHO and FMEnv of 70 and 85 decibels respectively for peak traffic hours while generally for low traffic hours the range of results got was below the threshold with just a few above 70db. There was also a statistically significant difference in peak traffic noise across all junctions as against the low traffic periods which proved to have no statistically significant difference from the analysis of variance (ANOVA) on the SPSS package. This goes to show that at peak traffic hours, road users are exposed to the dangers of nose pollution both acute and chronic effects and efforts have to be put in place to ensure a drastic reduction in the level of noise generated at peak traffic hours and considerably at low traffic hours.

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