Journal of Engineering Research and Reports

Volume 25, Issue 1, Page 1-10, 2023; Article no.JERR.98553
ISSN: 2582-2926

Assessment of Noise Pollution Levels at Major Motor Parks in Port Harcourt Metropolis, Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JERR/2023/v25i1866

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/98553

Original Research Article

Received: 09/02/2023
Accepted: 11/04/2023
Published: 25/04/2023

ABSTRACT

Two motor parks in Port Harcourt had their noise pollution levels examined. The motor parks at Waterlines and at Rumuokoro are among the busiest in the city and have a lot of nearby sources of noise. The relative humidity and temperature meters were used to measure the relative humidity and the temperature at the parks, respectively. The sound level meter was used to measure sound levels. A questionnaire was provided to 63 respondents (38 at Rumuokoro motor park and 25 at Waterlines based on willingness to participate) in order to get subjective data. Statistical Package for Social Science (SPSS) version 20 was used to compute the noise descriptors. Pearson correlation was employed to assess the link between the measured dependent variable (noise level) and the independent variables (temperature, humidity, wind speed and wind direction). Results show that both motor parks have similar noise sources. The identified noise sources were loudspeakers from music shops, car engines, car horns, power generators, loud arguments, and advertising of products by vendors and hawkers. Additionally, preachers with megaphones and vulcanizers were found at Rumuokoro automobile park. In Waterlines motor park, the lowest and highest noise levels were 51.0 and 73.1 dBA, while it was 52.1 and 83.3 dBA in Rumuokoro motor

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park. The respondent's knowledge of noise's health effects was considered. While most respondents acknowledged that high noise levels affect work productivity and cause hearing problems, most rejected that high noise levels affected their communication and sleep. This shows that noise pollution and its effects on physical, social, and psychological health require better education.

Keywords: Noise; Motor Park; questionnaire; pollution.

1. INTRODUCTION

Noise is any loud, unpleasant, or unexpected sound that is not desired [1]. Hence, noise that is exceptionally loud and uncontrolled and negatively impacts the environment, public health, and welfare is considered pollution [2]. The presence of excessive or undesired sound in the environment that harms people, animals, or the environment as a whole is referred to as noise pollution. Traffic noise, industrial noise, construction noise, and noise from recreational activities are all examples of this sort of environmental pollution that is brought on by human activity. The majority of noise pollution comes from moving objects, such as automobiles, buses, trucks, and aircraft. Construction sites, industries, and equipment may all produce loud, continuous noise that contributes to noise pollution. Human health and wellbeing can be seriously harmed by noise pollution, which can also cause hearing loss, sleep disturbances, stress, hypertension, and cardiovascular disease. Moreover, it may cause changes in behaviour, communication, and migratory patterns in animals.

The least discussed sources of noise in Nigeria's motor parks are loudspeakers and public address systems used to make announcements or advertise bus schedules, the constant idling of vehicles, shouts from people loading and unloading passengers, car horns used by drivers to signal their arrival or departure, street vendors and hawkers selling food and beverages, loud music played to amuse passengers while they wait, and loud sounds from generators. One of the unsettling challenges in municipal transportation management is the detrimental impact of noise on human health and the environment as a whole. People in and around motor parks are continually exposed to noise pollution, which puts them at risk for health issues due to running car engines, horns from moving cars, music, megaphones speakers, generators, and broken exhaust pipes [3]. The dangers of excessive loud exposure to human health include hearing loss, tinnitus, cardiovascular illness, hypertension, irritation, disturbed sleep, social and psychological effects, and psychological and social problems.

In Rivers State, numerous studies have been conducted over the years to evaluate and examine the noise levels in industrial workplaces, construction zones, public gathering places, commercial airports, and road traffic, but little has been done to evaluate the noise levels in motor parks and its effects on people and the environment. As reported by Ononugbo et al. [4], the equivalent noise level (L_{eq}) in a few commercial and industrial districts of Trans-Amadi. surpassed the allowed limit of 65 dBA (daytime) and 55 dBA (nighttime) noise levels. Also, both the estimated level of noise pollution (L_{np}) and the daily exposure to noise (L_{eq},d) were above the allowable limits. Alao and Avwiri [5] measured the noise levels of a few oil sites in Nigeria's Rivers State's Ogba/Egbema/Ndoni Local Government Area, and reported that the mean noise pollution levels collected from several stations were somewhat higher than the WHO outdoor limit but less than the Federal Environmental Protection Agency standard of 90 dBA. As a consequence of the host populations' ongoing daily exposure, this finding foresaw long-term health effects. Ugwoha et al. [6] looked at the amount of noise that customers and sellers at the Trans-Amadi market in Rivers State's Obio/Akpor Local Government Area are exposed to, and found that the noise indices were all higher than the permissible level of 65 dBA for business locations. So, it was determined that the Trans-Amadi market routinely produces high noise levels which may harm dealers' and purchasers' hearing organ and health.

At Rumu-Okwachi Village in the Obi/Akpor LGA of Rivers State, Udeh et al. [7] looked at the geographic distribution of noise from 12 religious' structures. The findings showed that a maximum equivalent noise level (L_{eq}) value of 75.5 dBA was recorded during the religious activities period, while a maximum Leq value of 63.3 dBA was recorded during the non-religious activities period. The geographical distribution of the L_{eq} at

all sample locations supported the noise map's prediction of higher L_{eq} values during religious occasions, with Sunday having the highest L_{eq} values, which varied from 69.2 to 75.5 dBA. When the noise indices were compared to the WHO's advised noise exposure limit, it was discovered that during religious activities, the L_{eq} values were greater than the WHO's advised noise norm, with the noise pollution level at its highest being 96.2 dBA. This implies that residents of this area could be bothered by the excessive noise levels. Omubo-Pepple et al. [8] used a survey of 200 respondents to learn more about the causes, impacts, and controls of noise pollution in the Port Harcourt Metropolis. Findings indicated that generators, road traffic, social and religious activities were the main sources of noise in the study region. Due to the proximity of most residential residences to these motor parks, it was vital to analyze the noise levels in Port Harcourt's main motor parks in order to aid with good urban planning and to understand the potential effects on the population's health.

2. MATERIALS AND METHODS

2.1 Description of Study Area

The study was carried out in two locations: Rumuokoro motor park in Obio-Akpor local government area and Waterlines motor park in Port Harcourt local government area all in Rivers State, Nigeria. These two motor parks were carefully selected based on their busy nature as they are used for travelling and conveying passengers both within and outside the state. Rumuokoro located within longitude E6°59'16.92" and latitude N4°51'54.41" at an elevation of about 14 meters is popularly known for its commercial activities. It is situated in a strategic location and serves as the meeting point of major roads in Nigerian Economy and the gateway to and from the city of Port Harcourt. The Rumuokoro motor park is usually the first point of call when arriving from or leaving for places such as: Delta state, Yenegoa, Benin City, Lagos, Abuja, Owerri, Onitsha and even the Port Harcourt International Airport. Rumuokoro hosts Federal Government College Rumuokoro Port Harcourt, Nigerian Army 2 Amphibious Brigade (Bori Camp), part of the Air force Base, Community Secondary School, Okoro nu Odo.

Waterlines motor park is situated along Olu-Obasanjo Road, Umueme, Port Harcourt, Rivers State, Nigeria. It is located between latitude and longitude 4°848'59.56" E and 7°0'29.81" N respectively in the northern region of the state at an elevation of about 15 meters. Waterlines is one of the busiest commercial areas in Port Harcourt. It is rife with socio-economic activities daily, some of which include presence of filling stations, banks, fast food and restaurants, health care centres, bars, shops, product advertisers and hawkers selling different items. Its busyness can also be attributed to linked roads and junctions. The satellite maps of the study areas are shown in Figs. 1 and 2. The reds dots indicate sampling stations.

Fig. 1. Satellite Map of Rumuokoro Motor Park

Fig. 2. Satellite Map of Waterlines Motor Park

2.2 Methods of Data Collection

Assessment was conducted in two locations; Rumuokoro motor park and Waterlines motor park. Five sampling stations were selected at each location making a total of ten sampling stations. The measurements at each location started from 7 am to 6 pm, which was divided into morning, afternoon and evening session. Primary data was obtained by measuring the sound pressure levels, temperature, relative humanity, wind speed and wind direction from each sample station. Sources of noise were obtained by observations and critical analysis. Questionnaire was used to get more information from those who spend much time in the motor parks on their view on noise within the premises. The noise level was measured using a factory calibrated digital sound level meter and the result was obtained as equivalent sound pressure levels (L_{eq}). The sound level meter (Landtek SL-5686P Digital Sound Level Meter) is a hand-held instrument with a microphone and it meets the IEC 651.2, ANSI 1.4.2 type 2 measuring level range of 30 – 130 dB. The sound level meter has an accuracy of 1 dB and frequency range of 20 – 12,500 Hz.

The measurements were made taking into account the weather and other environmental variables that can have an impact on the noise level. The sound level meter was held above the ground, its microphone pointed in the general direction of the potential noise sources, and it was held 1.2 m above the ground. There were no reflectors or other obstructions between the sound level meter microphone and the sound source when the noise levels were measured. Throughout a period of 25 minutes, the comparable sound pressure levels were measured at 5-minute intervals. For all sites, this process was carried out in three sessions each day: twice in the morning (7 am – 9 am), twice in the afternoon (12 pm – 2 pm), and twice in the evening (4 pm – 6 pm).

Temperature, relative humidity, wind speed, and wind direction are some of the environmental variables that were monitored. At each site, the parameters and noise levels were measured. Temperature and relative humidity were monitored using a digital temperature and humidity meter with an LCD display from Oauee. It is a clock with an interior and outdoor temperature and hygrometer, HTC-1 and HTC-2. To achieve reliable readings, the instrument was held such that the sensor had no body contact. A mobile Anemometer program that shows location and real-time data was used to determine the wind speed and direction. The Anemometer was programmed to measure outside wind direction in degrees and wind speed in m/s, km/h, and mph.

To gather opinions and viewpoints on noise in the research area from people who often visit car parks, a well-designed questionnaire was created. Oral interviews were used to administer the questionnaire in order to collect information from both competent and unable respondents. A total of 63 participants were involved in the oral interview, including 25 participants at Waterlines

Table 1. Coordinates of the sample stations

Waterlines Motor Park			Rumuokoro Motor Park		
Stations	**Latitude**	**Longitude**	**Stations**	**Latitude**	**Longitude**
S1	N4°48'58.65"	E7°0'29.73	S1	N4°52'2.59"	E6°59'40.27"
S2	N4°48'59.40"	E7°0'29.69	S2	N4°52'2.67"	E6°59'39.40"
S3	N4°48'58.60"	E7°0'29.30	S3	N4°52'21.68"	E6°59'29.97"
S4	N4°48'57.80"	E7°0'29.59	S4	N4°52'58.80"	E6°59'38.15"
S5	N4°48'58.70"	E7°0'29.79	S5	N4°52'1.16"	E6°59'38.80"

motor park and 38 participants at Rumuokoro motor park, respectively. The coordinates (longitude and latitude) of each sample station chosen from the research sites as stated in Table 1 were recorded using the global positioning system (GPS).

2.3 Methods of Data Analysis

Microsoft Excel and the IBM Statistical Package for Social Science (SPSS) version 20 were used to analyze the data. Microsoft Excel was built with noise measurements to make computing the noise descriptors simpler. To assess the link between the measured dependent and independent variables, SPSS's Pearson correlation was employed (noise levels, temperature, humidity, wind speed and wind direction). For simpler analysis, the output was transferred to Microsoft Excel. Equations 1 to 5 were utilized to perform the statistical analysis and noise metrics.

Mean is given as;

$$\bar{x} = \frac{\sum f}{N} \quad (1)$$

Standard deviation (S) is given as;

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{N}} \quad (2)$$

Variance is given as;

$$\text{Variance} = \sqrt{S} \quad (3)$$

Noise climate (NC) is given as;

$$NC = L_{10} - L_{90} \quad (4)$$

Noise Pollution Level, L_{NP}

$$L_{NP} = L_{50} + (L_{10} - L_{90}) + \frac{(L10 - L90)}{60} \quad (5)$$

where L_{10} = Sound pressure level exceeded 10% of the time

L_{90} = Sound pressure level exceeded 90% of the time

L_{50} = Sound pressure level exceeded 50% of the time.

3. RESULTS AND DISCUSSION

3.1 Identification of Sources of Noise

With a few exceptions, the noise sources found in the sample locations were all identical. The following has been noted as sources of noise at the Waterlines motor park: Loudspeakers or amplifiers being used to attract passengers, music stores using loudspeakers, automobile engines, car horns, power generators, disputes, and vendors and hawkers advertising their wares. The sources of noise found in Rumuokoro Motor Park include: Preachers using megaphones, automobile engines, car horns, power generators, disputes, merchants and hawkers promoting their wares, and the use of an amplifier or megaphone to attract passengers.

3.2 Environmental Parameters

In order to examine their effects on the noise levels, environmental factors were evaluated together with noise levels at each sample station in the two sites. The results are shown in Table 2. The relative humidity, temperature and wind speed of both motor parks are within the acceptable limit of 90%, -10^{o}C < Measured temperature < 50^{o}C, and 36,000 mph (10 m/s) respectively as reported by Agarwal [9] and Tripathy [10]. This implies that the measured noise levels in both motor parks were not affected by environmental factors.

3.3 Equivalent Noise Levels

The results of the minimum, maximum and mean Equivalent noise levels (L_{eq}) with their standard deviation and variance determined for each

sample station at the different sessions of the day for the two study locations are presented in Tables 3 and 4. In Waterlines motor park (Table 3), the mean of all measured noise levels at all times (morning, afternoon and evening) are above the recommended permissible limit of 60 dBA (day) and 50 dBA (night) for Residential, Industry or Small-scale production and Commerce by the National Environmental Standards and Regulations Enforcement Agency (NESREA). In Rumuokoro motor park (Table 4), similar situation as in Waterlines motor park was observed with the exception of station 4 (S4) afternoon (56.63 dBA) only. This indicates that the noise in motor parks is capable of causing noise pollution and the associated effects. A similar study in Rumuokoro motor park by Ideriah et al. [11] reported a slightly higher mean noise level range of 74.8 to 86.6 dBA compared to the mean noise level range of 61.2 to 72.8 dBA reported in this study. This slight variation could be due to variation in activities at the park during the period of measurements. Furthermore, the mean (68.63 and 72.82 dBA) of the maximum noise levels measured at Waterlines and Rumuokoro motor parks respectively are similar to the noise level range of 69.94 to 74.45 dBA reported by Salami et al. [3] for major motor parks in Ilorin Metropolis, Kwara State, Nigeria.

3.4 Noise Indices

The noise indices (L_{10}, L_{50}, L_{90}) were estimated due to the unsteady nature of noise while the noise climate (NC) and noise pollution level (L_{NP}) were calculated from Equations (4) and (5) to adequately describe the degree of annoyance caused by the measured noise. The results of the noise pollution levels and noise climate for the three sessions of the day (morning, afternoon, and evening) are presented Table 5 for Waterlines motor park and Rumuokoro motor park, respectively.

The motor parks' L_{10}, L_{50}, and L_{90} values show potential noise pollution. The noise pollution level is above the permissible limit by NESREA for a residential and business location. Constant exposure to high noise levels may cause stress, disorientation, restlessness, irritation, and hearing loss. Rumuokoro motor park's computed noise pollution levels for morning, afternoon, and evening are 78.02 dBA, 80.58 dBA, and 80.29 dBA, respectively. The vehicle park is louder and more populated in the afternoon, which may explain why the amount of noise pollution is greatest during that time. In Waterlines motor park, the noise pollution levels are 72.52 dBA in the morning, 67.31 dBA in the afternoon, and 68.10 dBA in the evening

Table 2. Environmental parameters for sample locations

	Waterlines Motor Park				Rumuokoro Motor Park			
Day	**R H**	**Temp**	**Wind speed**	**Wind direction**	**R H**	**Temp**	**Wind speed**	**Wind direction**
1	76%	27°C	8 mph	279 (W)	82%	26°C	9 mph	237(SW)
2	72%	27°C	6 mph	241(SW)	80%	26°C	11 mph	212(SW)
3	71%	28°C	5 mph	218(SW)	68%	28°C	8 mph	237(SW)

Note: RH = Relative Humidity

Table 3. Equivalent Noise Levels (L_{eq}) for Waterlines Motor Park

Station	Time	Mini L_{eq} dBA	Max L_{eq} dBA	Mean L_{eq} dBA	Variance
S1	Morning	63.40	73.10	66.95 ± 3.49	12.19
	Afternoon	60.60	64.60	63.07 ± 1.87	3.49
	Evening	57.00	64.20	60.45 ± 2.53	6.42
S2	Morning	67.00	73.00	70.68 ± 2.17	4.69
	Afternoon	65.90	70.00	68.62 ± 1.51	2.29
	Evening	63.60	70.40	67.28 ± 2.53	9.44
S3	Morning	62.00	70.10	65.87 ± 2.78	7.71
	Afternoon	63.80	66.20	65.02 ± 1.04	1.09
	Evening	51.00	65.70	59.58 ± 6.01	36.13
S4	Morning	67.80	72.30	70.10 ± 1.79	3.19
	Afternoon	51.00	67.80	66.10 ± 1.11	1.22
	Evening	64.40	67.10	65.68 ± 1.17	1.36
S5	Morning	60.00	69.10	65.87 ± 3.35	11.24
	Afternoon	62.20	68.10	65.67 ± 2.20	4.84
	Evening	62.60	67.80	64.90 ± 2.06	4.25

Table 4. Equivalent Noise Levels (L_{eq}) for Rumuokoro motor park

Station	Time	Mini L_{eq} dBA	Max L_{eq} dBA	Mean L_{eq} dBA	Variance
S1	Morning	61.2	81.1	73.58 ± 8.77	76.90
	Afternoon	61.6	81.1	74.58 ± 8.01	64.19
	Evening	61.3	82	73.42 ± 8.84	78.07
S2	Morning	64.2	77.2	68.83 ± 5.64	31.83
	Afternoon	67	83.3	72.07 ± 6.05	36.62
	Evening	67.3	77.6	71.62 ± 4.15	17.20
S3	Morning	65.8	68.1	67.17 ± 0.99	0.97
	Afternoon	62.3	67.2	64.85 ± 1.82	3.31
	Evening	61.9	66	64.27 ± 1.62	2.63
S4	Morning	57.1	62.7	60.63 ± 1.95	3.81
	Afternoon	52.6	63.1	56.63 ± 3.98	15.88
	Evening	52.1	62.9	57.05 ± 4.54	20.60
S5	Morning	61.4	74.6	68.75 ± 5.24	27.42
	Afternoon	60.2	72.2	67.17 ± 4.81	23.09
	Evening	61.7	73.2	68.18 ± 5.04	25.45

Table 5. Noise indices for Waterlines and Rumuokoro motor parks

Time	Waterlines Motor Park					Rumuokoro Motor Park				
	L_{10} (dBA)	L_{50} (dBA)	L_{90} (dBA)	NC (dBA)	L_{NP} (dBA)	L_{10} (dBA)	L_{50} (dBA)	L_{90} (dBA)	NC (dBA)	L_{NP} (dBA)
Morning	71.12	67.02	66.05	5.07	72.52	71.46	68.72	63.28	8.18	78.02
Afternoon	66.9	65.31	64.96	1.94	67.31	71.73	68.32	61.29	10.44	80.58
Evening	66.25	63.18	61.68	4.57	68.10	70.74	68.89	60.94	9.8	80.29

The Rumuokoro motor park has maximum L_{10} values of 71.73 dBA, L_{50} values of 68.89 dBA, and L_{90} values of 63.28 dBA, and lowest L_{10} values of 70.74 dBA, 68.32 dBA, and 60.94 dBA. The L_{10} occurred in the following order: afternoon > morning > evening, while the L_{90} (the background noise) was in the following order: morning > afternoon > evening. For L_{10} and L_{90} respectively, the waterlines motor park has minimum values of 66.25 dBA and 61.68 dBA and maximum values of 71.12 dBA and 66.05 dBA. The sequence of the peak (L_{10}) and background (L_{90}) noise levels is morning > afternoon > evening. At both Rumuokoro and Waterlines motor parks, all the stations have L_{90} and L_{10} values that are higher than the allowable limit, which might cause discomfort and hearing impairment. The sequence of the computed noise climate (NC) is afternoon > evening > morning in Rumuokoro motor park, and morning > evening > afternoon in Waterlines, indicating periods with greater noise variation, this variation being more in Rumuokoro motor park than in Waterlines motor park. Yet, a one-way ANOVA with a 95% confidence level shows that the difference in the noise levels at the different periods is not significant.

3.5 Questionnaire Analysis

Table 6 summarizes the responses of the respondents at Waterline Motor Park. The respondents generally agreed that the major source of noise in the park is the public address system which is in concord with the physical observations made. It is also in agreement with Salami et al. [3] findings which opined that the main cause of noise in motor parks is the solicitation of drivers and passengers using amplifiers and megaphones. Also, the respondents commonly agreed that the highest level of noise in the park is observed during morning hours on week days. This fits with the auto park's historical data on noise levels, and could be explained by the fact that there are more activities in the early hours on week days due to people rushing to school, work, appointments and other personal businesses. Furthermore, the respondents largely agreed that the noise level in the park is high enough to be annoying, reduce working efficiency, and affect hearing ability. More so, the respondents agreed that the introduction of a standard ticketing system will help reduce the noise level at the park. In addition, the respondent agreed that the Waterlines motor park needs structural rehabilitation, and the use of signs at designated

points in and around the park will bring orderliness and thus help in reducing the noise level in the motor park. However, the respondents generally disagreed that high level of noise disrupts effective communication in the motor park. The respondents also disagreed that continuous exposure to the noise level in the motor park will disrupts sleeping patterns. Finally, the respondents disagreed that the introduction of technology in ticketing and journey management will help reduce noise level in the park. This may be a result of their concern about losing their job since the usage of technology will make their services in the part unnecessary.

The summary of responses from respondents at Rumuokoro motor Park is presented in Table 7. The responses generally followed the pattern described for Waterlines motor park except for the respondents' general decision on whether high level of noise disrupts effective communication in the park, whether the introduction of technology in ticketing and journey management will help reduce noise level in the park, and whether the motor park needs structural rehabilitation. Respondents from Waterlines motor park is of the opinion that high level of noise does not disrupt effective communication in the park, and that the introduction of technology in ticketing and journey management will not help reduce noise level in the park. On the contrary, the respondents from Rumuokoro agreed that a high level of noise disrupts effective communication in the park, and that the introduction of technology in ticketing and journey management will help reduce noise level in the park. Also, while respondents from Waterlines motor park generally agreed that the motor park needs structural rehabilitation, the respondents from Rumuokoro disagreed on that. The variations in responses indicate workers disposition to protect their job as well as people's general attitude towards change. People will naturally protect what they deemed profitable, whether they are being harmed or not, and reject any change that threatens their source of livelihood, even if it is to protect their health and life. This suggests that there is a need for proper education on noise pollution and its negative consequences.

Table 6. Analysis of questionnaire for Waterlines Motor Park

Statement	SA	A	D	SD	WA	R
The major source of noise in the park is the public address system	11 44%	8 32%	2 8%	4 16%	3.04	Agreed
The highest level of noise in the park is observed during morning hours	13 52%	3 12%	7 28%	2 8%	3.08	Agreed
The highest level of noise in the park is observed on week days	9 36%	10 40%	4 16%	2 8%	3.04	Agreed
The noise level at the park is annoying	15 60%	9 36%	1 4%	0 0%	3.56	Agreed
High level of noise can reduce working efficiency	9 36%	12 48%	3 12%	1 4%	3.16	Agreed
High level of noise negatively affects hearing ability	15 60%	10 40%	0 0%	0 0%	3.6	Agreed
High level of noise disrupts effective communication in the park	2 8%	6 24%	10 40%	7 28%	2.12	Disagreed
Continuous exposure to high level of noise disrupts sleeping patterns	5 20%	2 8%	13 52%	5 20%	2.28	Disagreed
The introduction of a standard ticketing system will help reduce the noise level at the park	15 60%	3 12%	6 24%	1 4%	3.28	Agreed
The introduction of technology in ticketing and journey management will help reduce noise level in the park	5 20%	3 12%	4 16%	13 52%	2.0	Disagreed
The motor park needs structural rehabilitation	19 76%	6 24%	0 0%	0 0%	3.76	Agreed
The use of signs at designated points in and around the park will help visitors behave orderly thus reducing the noise level.	23 92%	2 8%	0 0%	0 0%	3.92	Agreed

SA-Strongly Agreed, A-Agreed, D-Disagreed and SD-Strongly Disagreed, WA- Weighted Mean, R- Remark.

Table 7. Analysis of questionnaire for Rumuokoro motor park

Statement	SA	A	D	SD	WA	R
The major source of noise in the park is the Public address system	15 40%	15 40%	3 7%	5 13%	3.05	Agreed
The highest level of noise in the park is observed during morning hours	13 34%	15 40%	8 21%	2 5%	3.02	Agreed
The highest level of noise in the park is observed on weekdays	12 32%	19 50%	4 11%	3 7%	3.05	Agreed
The noise level at the park is annoying	15 40%	17 45%	6 15%	0 0%	3.24	Agreed
High level of noise can reduce working efficiency	16 42%	15 39%	3 8%	4 11%	3.13	Agreed
High level of noise negatively affects hearing ability	15 40%	18 47%	5 13%	0 0%	3.26	Agreed
High level of noise disrupts effective communication in the park	18 47%	10 26%	6 16%	4 11%	3.12	Agreed
Continuous exposure to high level of noise disrupts sleeping patterns	6 16%	11 29%	15 39%	6 16%	2.44	Disagreed
The introduction of a standard ticketing system will help reduce the noise level at the park	19 50%	11 29%	6 16%	2 5%	3.23	Agreed
The introduction of technology in ticketing and journey management will help reduce noise level on the park	15 39%	13 34%	4 11%	6 16%	3.0	Agreed
The motor park needs structural rehabilitation	9 24%	7 18%	10 26%	12 32%	2.34	Disagreed
The use of signs at designated points in and around the park will help visitors behave orderly thus reducing the noise level	23 61%	15 39%	0 0%	0 0%	3.6	Agreed

SA-Strongly Agreed, A-Agreed, D-Disagreed and SD-Strongly Disagreed, WA- Weighted Mean, R- Remark

4. CONCLUSION

The assessment of noise pollution levels at major motor parks in Port Harcourt Metropolis, Rivers State, Nigeria has been carried out. The results obtained show that the noise sources in both motor parks are comparable, and include the use of an amplifier or megaphone to attract passengers, music stores using loudspeakers, automobile engines, car horns, power generators, disputes, and vendors and hawkers advertising their goods. Meanwhile, in Rumuokoro motor park, additional two sources of noise were discovered, which comprise megaphone-wielding preachers and vulcanizers. Waterlines motor park had 51.0 and 73.1 dBA as the lowest and highest noise levels respectively, while in Rumuokoro motor park, the lowest and highest noise levels recorded were 52.1 and 83.3 dBA, respectively. The responses obtained from both motor parks generally followed the same pattern except for the responses on disruption of effective communication, introduction of technology to help reduce noise level and need for structural rehabilitation. This suggests that there is a need for proper education on noise pollution and its negative consequences.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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