



## Evaluation of Equivalent Noise Levels across Some Commercial Areas of Warri and Benin Metropolis in Nigeria

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**ABSTRACT:** Globalisation has given rise to an increase in the amount of noise generated around us, such that man has adjusted to this increment without considering the possible risks associated with it. This study aims to measure the equivalent noise level in eighteen (18) locations in some commercial areas of Warri and Benin Metropolis in Nigeria using a noise level metre (Model: CEL-231). The assessment was done twice daily, during the day and at night. The results obtained revealed that the daytime equivalent noise level of both cities ranged from 48–68, 78–102 dBA for minimum and maximum noise levels, while the nighttime equivalent noise level ranged from 39–59, 59–83 dBA for minimum and maximum levels, respectively. It was observed that the daytime noise level values in some locations for both cities were higher than the nighttime values and also higher than the recommended standard noise quality description for daytime and nighttime duration as recommended by the World Health Organization (WHO) and some existing literature in Nigeria and across the globe. The reason for this noise level elevation is due to the activities of automobiles and tricycles plying the road incessantly, and again, these are major industrial cities with a lot of activities during the daytime. However, it can be recommended that those whose daily activities confine them to areas with unhealthy noise levels ensure at least 10 hours of recovery time in areas where the sound level is less than 65 dBA and also encourage the planting of trees in this vicinity.

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Noise pollution is a pervasive issue in commercial cities worldwide. With rapid urbanisation and industrialisation, the constant buzz of traffic, construction, and commercial activities has become an unavoidable part of urban life. Excessive noise levels disturb the tranquility of urban dwellers and cause detrimental effects on their physical and mental health. As such, it is crucial to delve into the causes and consequences of noise pollution in commercial cities to find solutions. (Bilewu *et al.*, 2019; Mansouri *et al.*, 2006; Amoatey *et al.*, 2020; Anomoharan, 2013).

However, transportation or road noise is the leading source of noise in many cities (Yilmaz and Ozer, 2005). Blake (2006) asserted that noise is an unwelcome, unwanted sound that emerges from human activity. Sound pressure is used to assess the study of sound: its production, transmission, and reception. The environment and the noise source's power output affect the sound pressure level. The ear's incredible capacity to process sounds is astounding. However, sound becomes an issue when it obstructs our ability to read, work, or engage in leisure activities.

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Sound is important in aspects of communication and to enjoy drama and musical performances. Some loud sounds are signals that alert us to an oncoming potential hazard ahead, such as an aeroplane about to land at the airport. Changes in sound pressure are responded to by the human hearing mechanism in a relative rather than absolute manner. This is why the sound pressure level is measured using a logarithmic scale known as the decibel (dB). The threshold of hearing, which corresponds to 0 dB, is the weakest sound that the human ear can detect. The threshold of pain, on the other hand, is defined as the level of sound pressure that causes pain in the ear and corresponds to 120 dB. A 3 dB variation in sound intensity is just enough to make such a difference perceptible. Nonetheless, one can perceive a 10 dB rise as twice the sound's volume. Two weighting networks, the A and C networks, are used in sound measuring. However, for environmental applications, the measurement is conducted using an A-weighted scale (dBA), which measures sound levels like those of the human ear. Noise pollution has been identified as a serious problem facing the world today. According to the WHO, noise is a hazardous substance that harms both human health and the environment. People in Nigeria, on the other hand, pay little attention to the significance of noise pollution and its harmful environmental implications. This is not the situation in other nations where adequate measures have been put in place to control and regulate this hazard (Anomohanran et al., 2008; Rafal and Emil, 2023). In every human activity, there is always an interference of noise; hence, one can categorise noise as an occupation (workplace noise) or environmental noise, which involves noise in all other areas, be they community, residential, or domestic (traffic, playground, sports, and music). Noise pollution is an environmental problem that constitutes a nuisance, and it has not been widely recognised in our growing society but has gained recognition in developed countries (Mangalekar *et al.*, 2012). Sources of environmental noise pollution in the urban locality are road vehicles, tricycles, heavy-duty trucks, and motorcycles (Usikalu and Kolawole, 2018). The World Health Organisation (WHO, 2006) noted that exposure to incessant noise at night leads to self-reported sleep disturbances and induced sleep, classified as health problems or challenges. It is evident in the literature that noise pollution disturbs sleep, causes fatigue and accidents, and reduces performance. Traffic noise pollution affects those living around road junctions in urban cities. As a result of the ever-present exposure to noise in these study environments, people lose their hearing ability, decreased human performance and action, put stress on the nervous system, annoyance, developed

hypertension, headaches, and increased blood pressure (Naish *et al.*, 2012; Esi *et al.*, 2015; Passchier-Vermeer and Asscher, 2000). The World Health Organization (WHO) Guidelines Development Group advises that noise levels from road traffic be kept at 53 decibels (dB). In addition, for nighttime noise exposure, it recommends decreasing noise levels caused by road traffic to less than 45 dB. In the Nigerian cities of Warri and Benin Metropolis, determining the levels of noise pollution is of utmost importance. With rapid urbanization and industrialization, these cities have experienced a surge in population and economic activities, resulting in increased noise pollution. Understanding the extent of noise pollution in these commercial cities is crucial for developing effective strategies to mitigate its negative impacts on the health and well-being of residents. Hence, the objective of this paper is to evaluate the Equivalent Noise Levels across Some Commercial Areas of Warri and Benin Metropolis in Nigeria

## MATERIALS AND METHOD

**Study area:** The study areas (Warri and Benin City) are cosmopolitan cities from the medieval located in the southern region of Nigeria, usually named the Niger Delta Area. The sampled locations and their geographical locations are presented in Tables 2 and 3 below. The study locations have a population of 1,397,646 (NPC, 2006). The occupation of the people in this region was mainly agriculture and craft before the establishment of numerous multinational companies and industries such as the Warri refinery and petrochemical industry and the Nigeria port authority. These companies came into being as a result of the natural resources (oil) found in this region, and this has equally increased the population of individuals residing in these areas and automatically turned into a commercial, industrial, and metropolitan city based on the influx of people seeking white collar jobs.

**Measurement of noise level:** The study was carried out using a portable sound level metre with model number CEL 231. This metre is used to determine the exposure level to noise in our environment. The sound metre reading starts at 20 decibels and not zero (0) because no environment is 100% free from noise and one cannot observe total quietness in an area. The ambient noise level was monitored and measured using the metre within the hour (8:00 a.m.–6:00 p.m.) during the daytime (LD) and the nighttime (LN) (10:00 p.m.–6:00 a.m.). The measurement was performed according to the instructions provided by Maiti in 2003. Basic safety measures were taken by choosing an acceptable and suitable distance from the source of sound to allow for sound resonance and echo. According to noise guidelines (2000), as updated in

2010, readings were taken and recorded every ten (10) seconds for six minutes at each point of measurement in the area (during the day and night).

**Table 1** Noise standards for ambient noise level

Area identity	Category of Area	Day time (dBA)	Night time (dBA)
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence zone area	50	40

## RESULTS AND DISCUSSION

The minimum and maximum daytime and nighttime noise levels in some selected locations in two prominent cities in the Niger Delta region of the southern part of Nigeria, together with their geographical locations, have been presented in Tables 1 – 4.

**Table 1:** Sampled areas and their geographical locations in Warri metropolis

Sample location	Geographical location	
	Latitude (degrees)	Longitude (degrees)
Effurun roundabout	5°34'23.35"N	5°47'2.78"E
DSC roundabout	5°34'14.72"N	5°48'32.38"E
P.T.I junction	5°34'24.19"N	5°48'0.31"E
Jakpa junction	5°33'22.58"N	5°47'4.62"E
Hausa quarter	5°30'59.81"N	5°45'42.36"E
Shagwolor(ekpan)	5°34'13.41"N	5°43'28.72"E
Okere market	5°31'38.20"N	5°44'43.18"E
Avenue (estate)	5°31'46.69"N	5°45'4.58"E
Igbudu market	5°31'8.87"N	5°45'35.77"E
Enerhen junction	5°30'56.85"N	5°44'12.22"E
Effurun market	5°33'48.74"N	5°47'40.75"E
Deco road	5°31'28.24"N	5°45'47.03"E

**Table 2:** Sampled areas and their geographical locations in Benin metropolis

Sample Location	Geographical location	
	Latitude (degrees)	Longitude (degrees)
Ring road	6°19'58.34"N	5°37'21.67"E
Siluko road	6°24'39.23"N	5°33'38.60"E
Akpakpava road	6°20'20.66"N	5°37'49.17"E
Ekenwan road	6°19'43.62"N	5°35'25.12"E
New Benin	6°21'3.09" N	5°37'52.52"E
Oba Market	6°20'7.18" N	5°37'12.70"E

The time between 8:00 a.m. and 6:00 p.m. is referred to as daytime, and the hours between 10:00 p.m. and 6:00 a.m. are known as nighttime. The measured ambient sound levels were compared to values from other published sources, such as the Environmental Protection Act of 1986 and the CPCB (Triparthy, 1999), as well as international norms. The noise

pollution controls and regulations laws from 2000 have established a standard for the environmental noise pollution level, which serves as a standard and limit for monitoring. Table 1 shows the ambient air quality criteria for noise for all four zones.

**Table 3:** Measured Mean Values of Noise Level in Some Selected Location in Warri Metropolis

Location	LD(dBA) Range	Mean (dBA)	LN(dBA) Range	Mean (dBA)
Effurun roundabout	51–81	67	48–75	63
DSC roundabout	54–82	68	51–69	61
P.T.I junction	52–78	67	51–66	66
Jakpa junction	51–76	65	47– 67	57
Hausa quarter	50–80	63	52–70	63
Shagwolor(ekpan)	48–82	62	39–62	50
Okere market	49–80	66	41–65	54
Avenue (estate)	50–93	73	41–63	53
Igbudu market	62–86	71	42-76	60
Enerhen junction	64–86	73	47–69	52
Effurun market	61–80	69	49-68	55
Deco road Total	53–79	67	49–68	52
		67.6		57.2

**Table 4:** Measured Mean Values of Noise Level in Some Selected Locations in Benin Metropolis

Location	LD(dBA) Range	Mean (dBA)	LN(dBA) Range	Mean (dBA)
Ring road	67–92	78	59–81	67
Siluko road	52–82	68	48–59	50
Akpakpava road	58–81	69	45–60	56
Ekenwan road	51–80	65	46–69	61
New Benin	68–102	94	58–83	62
Oba market	57–95	75	53–71	65
Total		74.8		60.2

The day-time equivalent noise levels for both cities ranged from 48 to 68, 78 to 102 dBA for minimum and maximum noise levels, and also from 39 to 59 and 59 to 83 dBA for minimum and maximum noise levels as shown in Tables 3 and 4 respectively. From Tables 3 and 4, Oba market, the ring road, and Igbudu market all had elevated noise levels (95, 92, and 93 dBA). This is also characterised by the presence of commercial and business activity in these areas, which could have increased noise levels. The quality of the daytime maximum noise level was observed to be above the typical noise quality description for daytime and nighttime at several locations in Warri and Benin.

Comparing the obtained results with the standard noise quality description for daytime and nighttime duration values as stated in Table 5, it is clear that New Benin, with a daytime equivalent noise level of 102 dBA has the greatest noise level which falls in the not allowed region following the criteria in Table 5. This highly

valuable outcome is explained by the area's high concentration of daytime activities.

**Table 5** Standard noise quality description for daytime and nighttime durations (WHO, 1996)

Leq (dBA)	Day time		Night time	
	Noise description	quality	Leq (dBA)	Noise description
0–30	Excellent quality		0–30	Excellent quality
31–40	Very good quality		31–40	Very good quality
41–60	Good quality		41–50	Good quality
61–75	Satisfactory quality		51–65	Satisfactory quality
76–90	Unsatisfactory		66–75	Unsatisfactory
91–110	Hazardous quality		76–90	Hazardous quality
> 111	Not allowed		> 90	Not allowed

*Leq = equivalent noise level*

The local road system is heavily utilized by automobiles, and this region experiences a lot of everyday commercial activity. This result agrees with that of Essanoh and Armah (2011), who discovered that business and vehicular activity are the primary sources of ambient noise. According to the research of Anomohanran *et al.* (2008), Sisman and Unver (2012), Onejefu *et al.* (2019), and Ajoku and Amadi-wali (2020), noisy areas are those with a lot of built-up commercial and business activity.

**Table 6:** Description of noise quality in Warri Metropolis

Location	Daytime	Nighttime
Effurun roundabout	Unsatisfactory	Satisfactory
DSC roundabout	Unsatisfactory	Satisfactory
P.T.I junction	Unsatisfactory	Unsatisfactory
Jakpa junction	Satisfactory	Satisfactory
Hausa quarter	Satisfactory	Satisfactory
Shagwolor(ekpan)	Satisfactory	Good quality
Okere market	Unsatisfactory	Satisfactory
Avenue (estate)	Unsatisfactory	Satisfactory
Igbudu market	Unsatisfactory	Satisfactory
Enerhen junction	Unsatisfactory	Satisfactory
Effurun market	Unsatisfactory	Satisfactory
Deco road	Unsatisfactory	Satisfactory

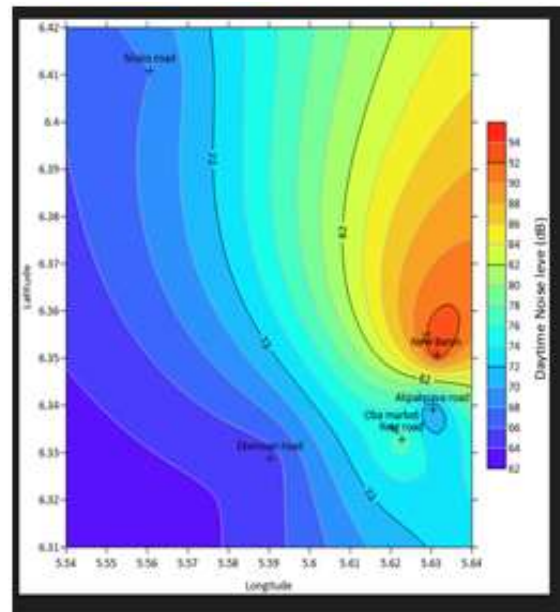
**Table 7** Description of noise quality in Benin Metropolis

Location	Daytime	Nighttime
Ring road	Hazardous quality	Unsatisfactory
Siluko road	Unsatisfactory	Good quality
Akpakpava road	Unsatisfactory	Satisfactory
Ekenwan road	Satisfactory	Satisfactory
New Benin	Not allowed	Satisfactory
Oba market	Unsatisfactory	Satisfactory

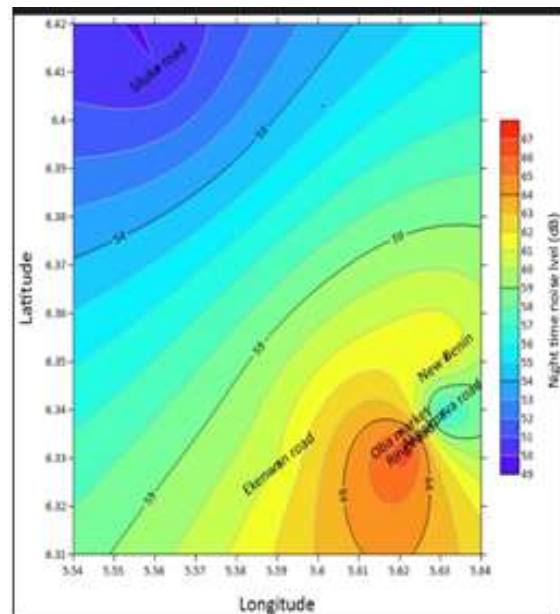
Tables 6 and 7 give the quality of the level of noise generated in the study areas, ranging from good quality to not allowed, but the majority of the locations were within the unsatisfactory range. The locations

(Okere Market, Avenue by Estate, Igbudu Market, Siluko Road, Akpakpava Road) fall within the satisfactory limit for nighttime noise levels of 62, 65, 63, 59 and 60 dBA, respectively.

The map depicting the daytime and nighttime noise levels in the studied locations is as shown in Figures 1-4. The figures below will serve as a guide for the populace to ascertain if the area is suitable to work and live in, considering the health implications.



**Fig 1:** Daytime noise map for Benin



**Fig 2:** Nighttime noise map for Benin



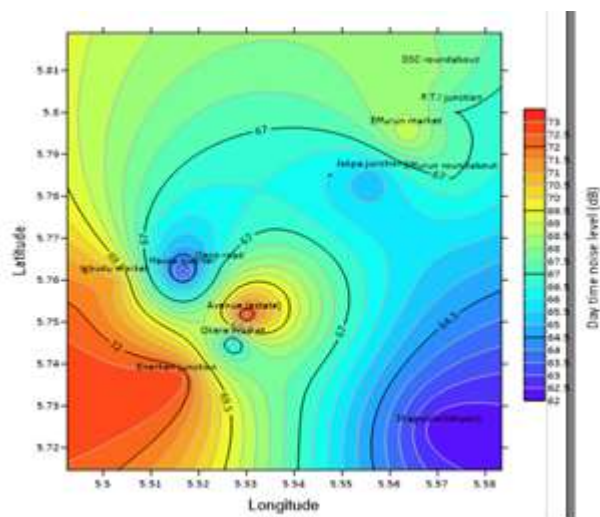


Fig 3: Daytime noise map for Warri

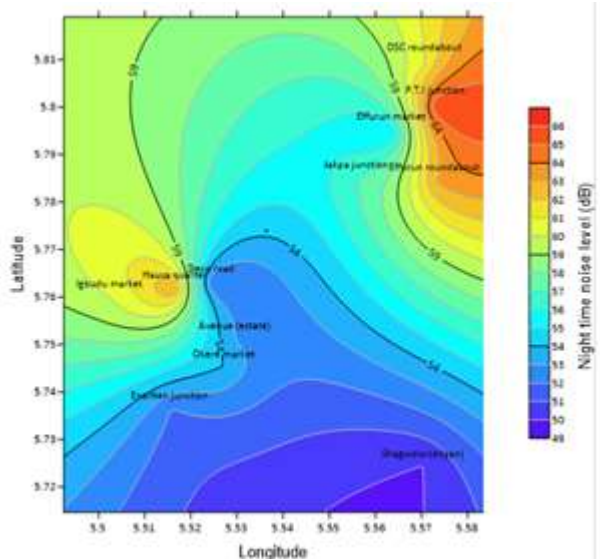


Fig 4: Night time noise map for Warri

**Conclusion:** Noise levels in Warri and Benin City were measured using a noise level meter. Nighttime equivalent noise levels ranged from 39 to 59 dBA for minimum noise and 59 to 83 dBA for maximum noise. Daytime equivalent noise levels ranged from 48 to 68 dBA for minimum noise and 78 to 102 dBA for maximum noise. High daytime noise levels can disrupt sleep, cause migraines, and cause severe hearing loss, potentially leading to partial deafness. Therefore, people whose daily occupations force them into noisy locations should ensure at least 10 hours of recovery time when the sound level exceeds the acceptable range.

**REFERENCES**

Abulude, FO; Fagbayide, SD; Olubayode, SA; Adeoya, EA (2018). Assessment of noise pollution

due to generators in Akure, Ondo State, Nigeria. *Environ. Res. Technol.* 1(3): 59-62

Ajoku, BC; Amadi-Wali, O (2020). Spatio-Temporal Analysis of Noise Levels across Hotspot Areas in Port Harcourt Metropolis, Rivers State, Nigeria. *J. Geo. Environ. Earth Sci. Int.* 24(5): 30-40

Amoatey, P; Omidvarbona, H; Baawain, MS; Al-Mayahi, A; Al-Mamun, A; Al-Harthy, I (2020). Exposure assessment to road traffic noise levels and health effects in an arid urban area. *Environ Sci. Pollut. Res.* 27(28): 35051-35064  
<https://doi.org/10.1007/s11356-020-09785-y>

Anomohanran, O; Iwegbue, CMA; Oghenerhoro, O; Egbai, JC (2008). Investigation of environmental noise pollution level of Abraka in Delta state Nigeria. *Trends in Appl. Sci. Res.* 292-297

Anomohanran, O (2013). Evaluation of environmental noise pollution in Abuja, the capital city of Nigeria. *Int. J. Res. Res. Appl. Stud.* 4(2): 470 - 476

Bilewu, SO; Salami, AW; Ayanshola, AM; Yusuf, IT (2019). Assessment of Noise from Transportation Systems in Ilorin, Nigeria. *Nig. J. Technol. Dev.* 16(3):98 -104

Blake, D (2006). *Sound and unwanted sound*, Fourth edition, Canada publication, Canada

Esi, OE; Edomi, O; Rotu, AR (2015). Assessment of environmental traffic noise pollution in Uvwie Local Government Area of Delta State. Nigeria. Council for innovative research. *J. Adv. Phys.* 11(4): 3218-3223

Essandoh, P; Armah, F (2011). Determination of ambient noise levels in the main commercial area of cape coast, Ghana. *Res. J. Environ. Earth Sci.* 637-644

Maiti, SK (2003). *Handbook of methods in Environmental studies; vol. 2: Air, noise and overburden analysis* ABD publication: 110 - 121.

Mangalekar, SB; Jadhav, AS; Rant, PD (2012). Study of noise pollution in Kolhapur city, Maharashtra India. *Uni. J. Environ. Res. Tech.* 65-69

Mansour; N, Pourmahabadia, M; Ghasemkhani, M (2006). Road Traffic Noise in Downtown Area of Tehran. *J Environ. H Sci. Eng.* 3(4): 267-272

- Naish, DA; Tan, AC; Demirbilela, FN (2012). Estimating Health Related costs and savings from Balcony Acoustic design for road traffic noise. *Appl. Acous.* 73: 497
- Nigeria national pollution and housing (CENSUS, 2006)
- Onjefu, SA; Ejembi, E; Onjefu, LA (2019). Measurement of Noise Pollution in Northern Industrial Areas of Windhoek, Namibia. *J. Environ. Protect.* 10: 1144-1154. <https://doi.org/10.4236/jep.2019.109068>
- Passchier-Vermeer, W; Passchier, WF (2000). Noise Exposure and Public Health. *Environ. H Per.* 108: 123 <https://doi.org/10.2307/3454637>
- Rafł Mlynski; Emil Kozłowski (2023). Impulse noise measurement in view of noise hazard assessment and use of hearing protectors. *Int. J. Occu. Saf. Erg.* 29(2): 528 – 537
- Sisman, O; Unver, E (2012). Day and Night noise pollution study in some major towns in Delta State Nigeria. *Ghana J Sci.* 47-54
- Tripathy, DB (1999). Noise pollution. A.P.H Publishing Corporation, New Delhi
- Usikalu, MR; Kolawole, O (2018). Assessment of Noise Pollution in Selected Locations in Ota, Nigeria. *Int. J. Mech. Eng. Technol.* 9(9): 1212–1218
- World Health Organization, WHO (2006) “Environmental criteria and standard. Noise abatement and control, 24 CFR, 58-59
- Yilmaz, H; Ozer, S (2005). Evaluation and Analysis of Environmental Noise Pollution in the City of Erzurum, Turkey. *Int. J. Environ. Pollut.* 23(4): 438-448