International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 505-512 www.ijaem.net ISSN: 2395-5252

Comparative Analysis of Maximum and Intermittent Noise Levels from Different Areas within Rivers State University Campus, Port Harcourt, Nigeria

[1]Okoro, K.O., [2]Eze, C.L.,[2]Gobo, A.E., and [2]Ayotamuno, A.
[1]Department of Environmental Planning Research and Statistic, Rivers State Ministry of Environment, Port Harcourt
[2]Institute of Geoscience and Environmental Management, Rivers State University, Port Harcourt, Nigeria

Date of Submission: 05-09-2022 Date of Acceptance: 13-09-2022

ABSTRACT
The study compared the maximum and intermittent noise levels from different areas within Rivers State University Campus, Port Harcourt, Nigeria with a view to considering different landuse within the University Campus. This study used Type 1 sound level meter to monitor noise levels in the business area, residential area, administrative area and classroom area taken at every 15 minutes beginning from 10 am to 4pm Descriptive statistics involving the minimum, maximum, mean and standard deviation values were employed in the data analysis. Results showed that the residential area produced the least noise compared to the other areas. Noise levels ranged from 74.8dBA to 75.8dBA but at 1.25 pm to 79.9 dBA, at 2.26pm it was 95.7 dB and at 3.11 pm to 86.1 dBA. The noise level at the classroom area ranged from 73.1dBA to 86.1dBA with the highest noise levels of 95 dBA. Business centers experienced an increase in noise levels from 10:20am when noise moved up gradually from 77.7dBA to 85.1dBA at 10:35am with another increase of 89.8dBA at 3:26pm. Noise levels at administration area ranged from 78.6dBA to 92.2dBA. However, results showed that the intermittent noise level was highest in the business and residential areas were high. The study concluded that the business area in Rivers State University produced the most noise and was closely followed by the Classroom area. The residential area was the closest to the national limit although all areas in Rivers State University exceed the national limit of 45dBA set by NESREA for an academic institution of higher learning. Thus, the noise levels generated in all the areas are all significantly higher than the noise limit set for schools. The study therefore recommended among others that the management of the institutions should regulate the use of individual generators in the Institutions generally and business areas in particular; and that the business areas should be linked to the national grid or the institutions power source.

Keywords: Maximum, Intermittent, Noise, Business area, Classroom area, Administration area, Residential area, Sound meter

I. INTRODUCTION

Noise is an unwanted or undesired sound that could serve as a disturbance. Environmental noise is any unwanted or harmful outdoor sound created by human activities that could cause an adverse effect to the quality of life of the individuals within that environment Piccolo et al., (2005). Noise pollution has raised global concerns and has poised to be harmful to the lives of individuals. Noise surveys treating the problem of noise pollution in many cities throughout the world have been conducted Peter et al., (2008), Rehdanz and Maddison, (2008). Depending on the temporal variations in sound pressure level, noise may be classified as steady, non-steady, fluctuating noise and tonal noise. Several research has been concerned with the adverse effect of noise on the auditory system Pachpande et al., (2005), and it has now been discovered that the exposure to high degrees of noise can lead to direct hearing loss and/or hearing impairment Prasher, (2003). Lots of researches have also been conducted on the relationship between the level of people's reaction to noise and their exposure to industrial noise in different regions. Zannin et al., (2003); Gorai et al., (2006). Recent research on noise has also been conducted to discover the relationship between noise and its non-auditory effects Xiangpu, (2022). There are some basic qualities associated with sound or noise. These qualities are amplitude, frequency, wavelength, speed and sound pressure.Pressure waves occur as a result of certain source vibration that causes pressure changes in air or atmosphere. Perceived sound was comprised of numerous pressure waves of varying characteristics.For a young individual, 20-20,000 Hz is considered to be the normal perception range. The older the person becomes, there will be an obvious decrease in the highest frequency that individuals can detect. Human speech frequencies are within the range of 500 Hz to 4,000 Hz Xiangpu, (2022). Communication through speech, sounds from playing children, music, natural and industrial sounds are of great importance. But when these sounds become unbearable, it is perceived as an unwanted sound called noise or nuisance. Noise has lots of adverse effects on the human ear and also on the environment. These effects can range from physiological to psychological which greatly and adversely affect the well-being of humans and their environment.

Environmental noise as the noise produced from all sources apart from those generated in the industrial workplace or an unwanted acoustic signal or sound dumped into the environment without regard of its adverse effect on both man and the environment, which in most cases the acoustic signal sounds are louder than normal acceptable levels (Oloruntoba et al., 2012; Okeke and George, 2015). The effect of noise on the human ear depends on its loudness (amplitude) and frequency of the wave (pitch) (Kaushik and Kaushik, 2008). Generally, noise pollution can be generated from stationary/point, mobile, indoor or outdoor sources. Nevertheless, specific sources of noise pollution include industrial plants; power plants; construction sites; transportation modes such as railways, airplane traffic and automobile traffic; blenders and fruit mixers at homes; emergency service sirens like ambulances, bullion vans, security vehicles, fire-fighter trucks; electricity generators; loud music and public address systems (FEPA, 1991; Kaushik and Kaushik, 2008; Oyedepo, 2012), employed by socio-political and religious activities notable of political parties, government agencies, churches and mosques.

The effects of noise pollution on humans are numerous depending on the sound intensity and length of time of exposure to the sound. These include interference with verbal communication; temporary or permanent hearing damages/loss; physiological and psychological changes; hypertension; insomnia and going to sleep late; blood pressure changes; behavioural changes; emotional changes; irritability, stress, anxiety; and reduction in working efficiency (Kaushik and Kaushik, 2008; WHO, 2005; Okeke and George, 2015). Noise pollution within residential neighbourhoods is a product of numerous other activities other than those normally expected, especially with the mixed and interwoven uses to which residential landuse is put, and it is important to consider all these contributing sources. FEPA (1991) reported that most industrial estates exist alongside or close to residential areas, whereas exposure to industrial and other forms of noise can induce hearing loss and other pathological changes in the affected population. Obafemi (2006) noted that noise was regarded as an ordinary unwanted sound but has in contemporary time become a nuisance which contributes immensely to the degradation of the urban environment.

All tertiary institutions in Rivers State have business areas for commercial activities. These Business Areas have noisy individual generators which run almost throughout the learning and office working hours. Often times, students are seen chatting and shouting uncontrolled in groups while lectures and examinations are going on. Even most of the tertiary institutions have been turned into event centers with a lot of social activities such as marriage ceremonies, child dedication, naming ceremonies and so on producing high levels of noise in these Institutions.

Majority of the previous studies did not account for noise in the tertiary institutions especially in Rivers State. Furthermore, noise threshold data in the previous works have been based on industrial activities without much available noise data mapping as it relates to educational Institutions where noise control is needed most. Most of the works looked at the magnitude of the noise to infer its effect without tonal noise analysis. A tonal noise will have effect more on the reported value of non-tonal noise. Measurement of background noise in most available literature is always mingled with intermittent noise data. For effective noise analysis, it was important to separate their values. Also, most available literatures did not consider noise percentile, probably most of them did not use Type 1 noise meter. It is imperative to state that different landuse in the tertiary institution can account for different noise levels and must be accorded more attention. It is against these backdrops that this study considers the imperative to undertake a comparative analysis comparative analysis of maximum noise levels from different areas within Rivers State University Campus, Port Harcourt, Nigeria.

II. MATERIALS AND METHODS

The study area coveredthe Rivers State University CampusNkpolu-Orowurukwo, Port Harcourt (Figure 1). The study location is located in the latitudes between 4° 47'30''N and 4° 52'30''N and longitudes between 6° 58'30''E and 6° 59' 0''E.As at the time of this study, the population of Rivers State University has the staff strength of 1,870 and students population of 29,939. The figures were gotten from the records department of the institution.

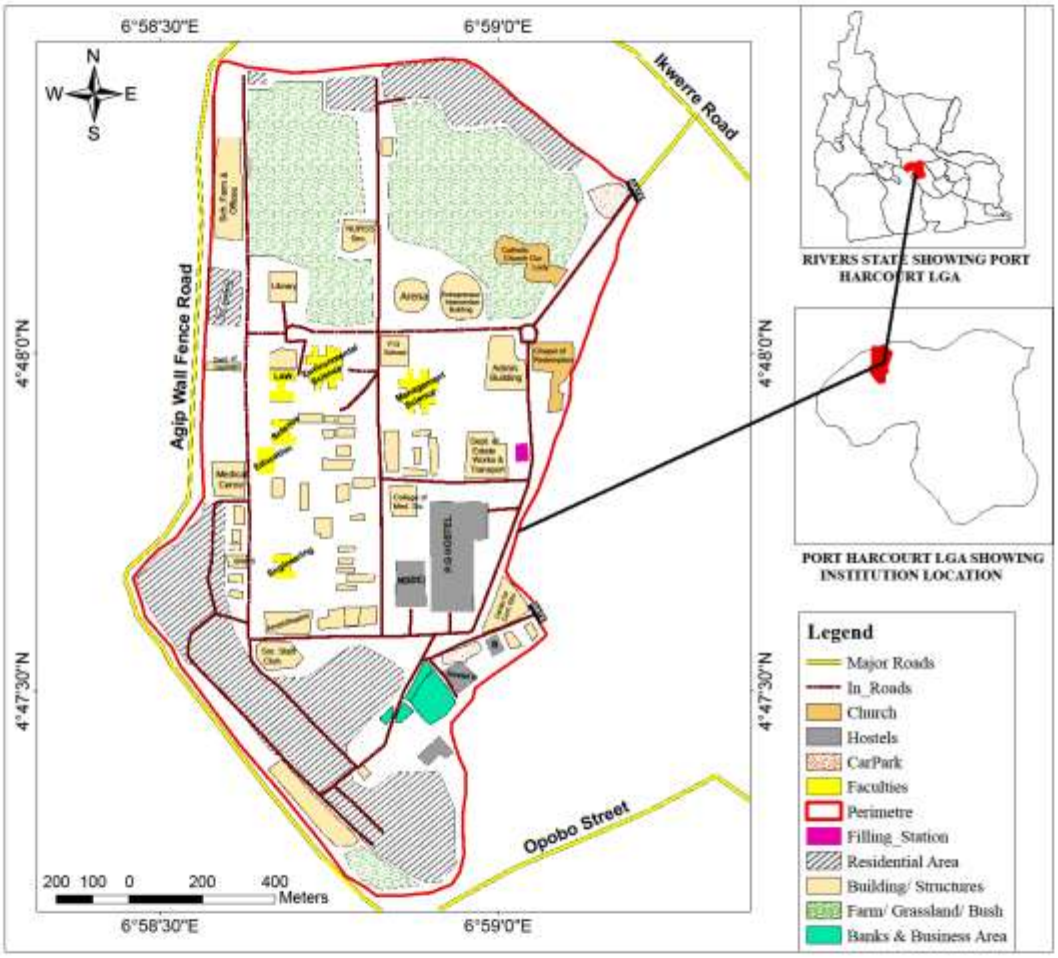

Figure 1. Map of Rivers State University (RSU), Nkpolu-Orowurukwo, Port Harcourt

Instrumentation and Measurement Protocol

The maximum noise level (LAmax) for the selected areas of the institution were plotted to identify the sources of noise and the noise profile in the areas. The comparison of the LAmax for the same areas of different institutions was also plotted on noise levels versus time graph. This study used Type 1 sound level meter to monitor noise in the study locations. This approach was considered very suitable because it clearly analyzed the threshold and degree of the noise impact.Therefore, meteorological mobile data stations (MDS) were established. The meter was set on "A" weighting to filter out the very low and very high frequency components of the sound and measures primarily frequencies in the 20 – 20,000Hz range which was the area of greatest sensitivity to the human ear.All measurements of sound pressure levels and their variations overtime was made using the fast response time to provide sound pressure measurements more representative of human hearing.Measurement duration was 8hours at each measurement station. Readings were logged and recorded at interval of 15munites, 800hours and 1600hours.The microphone was located at least 3.5m from the sound-reflecting surfaces on the tripod free of any structures as much as practicable possible to minimize sound reflecting off such

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 505-512 www.ijaem.net ISSN: 2395-5252

structures and to obtain accurate data possible.The microphone was placed at a height between 1.1 and 1.3m above the ground surface, the approximate average of the ear height of an individual. There were four measurement points namely Administration building, Classroom area, Residential area and Business centers.

Finally, the intermittent noise was determined by subtracting LA95 from LA05. Intermittent noise was inferred only when this difference was greater than 5dBA as recommended by ISO 1987 limit of intermittent noise. Descriptive statistics involving the minimum, maximum, mean and standard deviation values were employed in the data analysis. Results of the analysis were presented in graphs and tables.

III. RESULTS AND DISCUSSIONS

Spatio-temporal Comparison of Maximum Noise Levels (LA_{max}) in Rivers State University

In Figure 2, the residential area produced the least noise compared to the other areas. Noise levels ranged from 74.8dBA to 75.8dBA at most times with spikes seen at 95 dBA at different times owing to the overflight of helicopters. The gradual increase in noise levels above the 75.8dBA occurs from 1:11pm to 1:25pm where noise moved up from 72.9dBA to 79.9dBA. A drop in noise to 68.8dBA occurs but another increase was seen from 68.8dBA to 95.7dBA at 2:26pm. The third increase was seen at 2:56pm when noise moved up from 76.5dBA to 82.4dBA at 3:11pm. The noise level at the Classroom area ranged from 73.1dBA to 86.1dBA with the highest noise levels produced during 95 dBA.

This corresponds to the time of the use of public address systems and generators for lectures. Noise levels ranged from 82.5dBA to 85.8dBA when classes were in session but a decrease in noise levels occurred from 85.4dBA at 11:35pm to 72.9dBA at 1:11pm. This drop in noise levels occurred most probably when lectures ended and students left Classrooms gradually. The highest noise levels are produced during the periods that there was no power supply from the school and Business centers or residential owners gradually turn on their generators to meet the demands of their customers. An increase in noise levels was seen from 10:20am when noise moved up gradually from 77.7dBA to 85.1dBA at 10:35am. A gradual reduction occurred from this point to 77.4dBA and another increase in noise levels to 87.3dBA occurred at 12:41pm. Noise ranged from 79.7dBA at 1:11pm to 77.2dBA at 3:11pm and from that point an increase occurred to 89.8dBA at 3:26pm. LAmax values are added up logarithmically and not arithmetically therefore the noise recorded was that of the generator with the highest sound at that time. The administration area was exposed to the most noise owing to frequent vehicular movement and the overflight of helicopters. Noise levels here ranged from 78.6dBA to 92.2dBA.

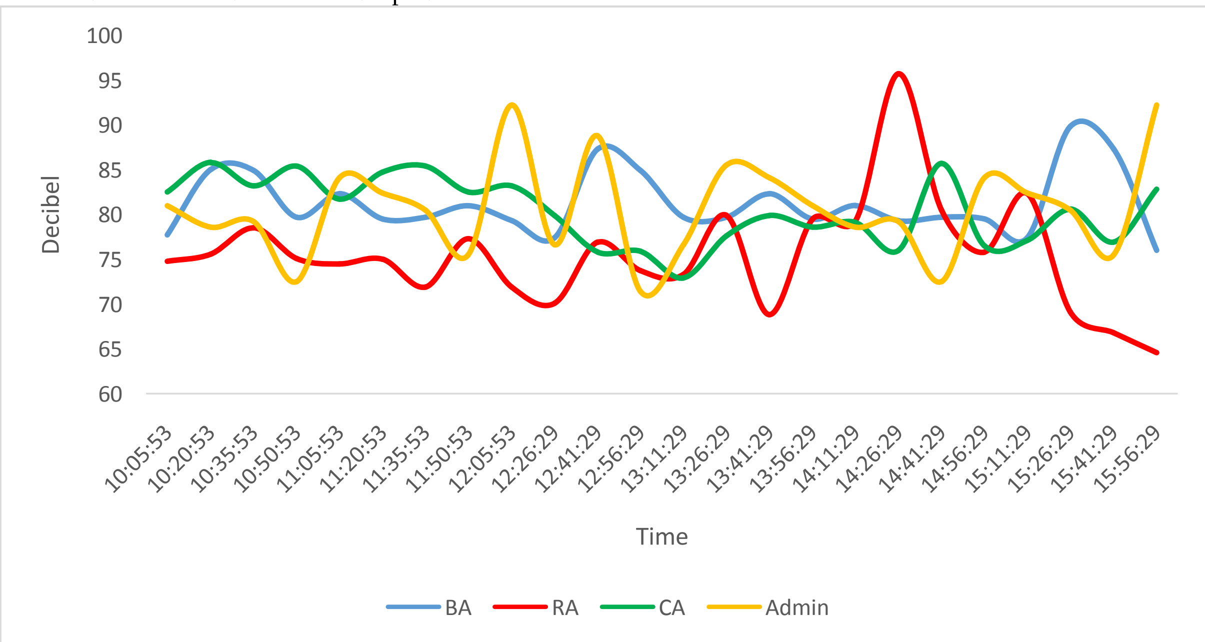

Figure 2: Noise Chart Showing Noise Levels at Different Areas in Rivers State University
Key:
BA- Business Area; RA- Residential Area; CA- Classroom Area; Admin – Administration Building

Intermittent Noise in Rivers State University

In Tables 1 to 4, it was observed that noise was steady at the classroom area but this was not the same at the business area. There was a high level of intermittent noise at the Business area and this was most probably caused by the usage of generators during power outage and also vehicular movement. The residential area also showed a high level of intermittent noise as a result of vehicular movement and noise from car horns. The administration area also produced intermittent noise owing to occasional overflight of helicopters, car horns and vehicular movement.

Table 1: Intermittent Noise at Classroom Area in Rivers State University

Time	LA05	LA95	Intermittent Noise (dBA)
10:05:53	76.1	69.8	6.3
10:20:53	74.6	67.1	0.6
10:35:53	78.2	66.9	0.7
10:50:53	78.4	69.1	0.7
11:05:53	77.2	73.1	0.3
11:20:53	78.1	75.1	0.2
11:35:53	78.4	69.1	0.7
11:50:53	76.1	69.8	0.6
12:05:53	78.2	66.9	0.7
12:20:29	68.7	62.5	0.5
12:35:29	68.6	62.6	0.5
12:50:29	68.3	61.3	0.5
13:05:29	66.9	61.1	0.5
13:20:29	69.7	61.8	0.7
13:35:29	71.1	62.4	0.8
13:50:29	72.3	64.6	0.8
14:05:29	67.9	60.8	0.7
14:20:29	67	60	0.5
14:35:29	68.8	60.4	0.8
14:50:29	69.4	61.1	1.2
15:05:29	69.5	60.7	0.9
15:20:29	69.9	62.5	0.6
15:35:29	69.4	62.5	0.4
15:50:29	73.1	66	0.5

Table 2: Intermittent Noise at Business Area in Rivers State University

Time	LA05 (dBA)	LA95 (dBA)	Intermittent Noise (dBA)
10:10:13	67.9	65.3	2.6
10:25:13	68.4	65.4	3
10:40:13	69.8	66.3	3.5
10:55:13	71.8	61.7	10.1
11:10:13	74.6	48.1	26.5
11:25:13	71.3	54.7	16.6
11:40:13	71.8	61.7	10.1
11:55:13	72.7	68.2	4.5
12:10:13	77.8	59.4	18.4
12:25:13	73.2	71.1	1.5
12:40:13	74	69.7	4.3
12:55:13	69.8	66.3	3.5
13:10:13	71.8	61.7	10.1
13:25:13	71.8	61.7	10.1
13:40:13	74.6	48.1	26.5
13:55:13	71.3	54.7	16.6

14:10:13	**72.7**	**68.2**	**4.5**
14:25:13	**77.8**	**59.4**	**18.4**
14:40:13	**71.8**	**61.7**	**10.1**
14:55:13	**73.4**	**71.5**	**1.9**
15:10:13	**73.2**	**71.7**	**1.5**
15:25:13	**76.4**	**70.1**	**6.3**
15:40:13	**74**	**69.7**	**4.3**
15:55:13	**74.2**	**72.2**	**2**

Table 3: Intermittent Noise at Residential Area in Rivers State University

Time	**LA05 (dBA)**	**LA95 (dBA)**	**Intermittent Noise (dBA)**
10:20:53	**57.9**	**42.5**	**15.4**
10:35:53	**59**	**41.9**	**17.1**
10:50:53	**64.6**	**41.6**	**23**
11:05:53	**51.9**	**37.5**	**14.4**
11:20:53	**56.6**	**37.3**	**19.3**
11:35:53	**52.2**	**37.3**	**14.9**
11:50:53	**51.3**	**37.5**	**13.8**
12:05:53	**53.3**	**38.2**	**15.1**
10:20:53	**46**	**38.2**	**7.8**
12:26:29	**51.4**	**38.4**	**13**
12:41:29	**64.6**	**38**	**26.6**
12:56:29	**67**	**58.2**	**8.8**
13:11:29	**71.9**	**57.5**	**14.4**
13:26:29	**75.5**	**54.4**	**21.1**
13:41:29	**64.3**	**50.2**	**14.1**
13:56:29	**71.3**	**54.7**	**16.6**
14:11:29	**77.8**	**59.4**	**18.4**
14:26:29	**61.8**	**48.4**	**13.4**
14:41:29	**60.9**	**44.8**	**16.1**
14:56:29	**70**	**48.4**	**21.6**
15:11:29	**74.6**	**48.1**	**26.5**
15:26:29	**60.6**	**47.7**	**12.9**
15:41:29	**58**	**48.4**	**9.6**
15:56:29	**59.3**	**49**	**10.3**

Table 4: Intermittent Noise at Administration Area in Rivers State University

Time	**LA05**	**LA95**	**Intermittent Noise**
10:00:50	**65.7**	**53.2**	**12.5**
10:15:50	**63.4**	**53.8**	**9.6**
10:30:50	**63**	**53.5**	**9.5**
10:45:50	**60.2**	**53**	**7.2**
11:00:50	**61.4**	**50**	**11.4**
11:15:50	**63.3**	**50.7**	**12.6**

11:30:50	**65.3**	**52**	**13.3**
11:45:50	**62.2**	**51.8**	**10.4**
12:00:36	**61.6**	**51.8**	**9.8**
12:15:36	**60.9**	**51.3**	**9.6**
12:30:36	**61.8**	**53.5**	**8.3**
12:45:36	**60.5**	**52.6**	**7.9**
13:00:36	**63.8**	**51.4**	**12.4**
13:15:36	**64.2**	**53.6**	**10.6**
13:30:36	**63.4**	**53.6**	**9.8**
13:45:36	**65.7**	**53.2**	**12.5**
14:00:36	**63.4**	**53.8**	**9.6**
14:15:36	**63**	**53.5**	**9.5**
14:30:36	**60.2**	**53**	**7.2**
14:45:36	**61.4**	**50**	**11.4**
15:00:36	**63.3**	**50.7**	**12.6**
15:15:36	**65.3**	**52**	**13.3**
15:30:36	**62.2**	**51.8**	**10.4**
15:45:36	**61.6**	**51.8**	**9.8**

IV. CONCLUSION AND RECOMMENDATIONS

It is concluded that the business area in Rivers State University produced the most noise and was closely followed by the Classroom area. The Residential area was the closest to the national limit although all areas in Rivers State University exceed the national limit of 45dBA set by NESREA for Institutions of higher learning. The noise levels generated in all the areas are all significantly higher than the noise limit set for schools. The study therefore recommended that the management of the Institutions should regulate the use of individual generators in the Institutions generally and Business areas in particular; and that the business areas should be linked to the national grid or the Institutions power source.

REFERENCES

[1]. FEPA (1991). National Interim Guidelines and Standard for Industrial Effluents, Gaseous Emission, and Hazardous Waste in Nigeria. Federal Environmental Protection Agency (FEPA), 52

[2]. Kaushik and Kaushik (2008). Environmental Studies (As Per Mysore University Syllabus), Third Edition, New Age International Publishers.

[3]. Obafemi, A. A. (2006). “Spatio Temporal Analysis of Noise Pollution in Port Harcourt Metropolis.”Ph.D Dissertation, Department of Geography and Environmental Management, University of Port Harcourt, Choba, Rivers State.

[4]. Okeke, P. N and George, D. M. C (2015). Evaluation of Ambient Noise Levels in Port Harcourt Metropolis, South-South, Nigeria.IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) e-ISSN: 2319-2402,p-ISSN: 2319-2399.Volume 9, Issue 7 Ver. I (July. 2015), PP 54-60www.iosrjournals.org

[5]. Oloruntoba E. O., Ademola R.A., Sridhar M. K. C., Agbola S. A., Omokhodion F. O., Ana G.R.E.E and Alabi R. T (2012) ..Urban Environmental Noise Pollution and Perceived Health Effects in Ibadan, Nigeria, Afr. J. Biomed. Res.Vol.15 (May 2012); 77 - 84

[6]. Oyedepo, S. O. (2012). Noise Pollution in Urban Areas; The Neglected Dimension. Environmental Research Journal. 6(4):259-271.

[7]. Pachpande, B.G., Patel, V.S., Patil, R.D., Girase, M.R., & Ingle, S.T. (2005). Assessment of hearing loss in school 32 teachers and students exposed to highway traffic noise pollution. Journal of Ecophysiology and Occupational. Health, 5(1&2), 123-126.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 505-512 www.ijaem.net ISSN: 2395-5252

[8]. Peter, G., Kovalchik., Rudy, J., Matetic., Adam, K., Smith., & Bealko, B. (2008). "Application of Prevention through Design for Hearing Loss in the Mining Industry". Journal of Safe Research, 39, 251-254.

[9]. Piccolo, A., Plutino, D., & Cannistraro, G. (2005). "Evaluation and analysis of the environmental noise of Messina, Italy". Applied Acoustics, 66, 447–465.

[10]. Prasher, D. (2003). "Estimation of hearing damage from noise exposure". World Health Organization and European Centre for Environment and Health Report on the Technical meeting of exposure–response relationships of noise on health, Bonn, Germany. 17–19.

[11]. Rehdanz, K., & Maddison, D. (2008). "Local environmental quality and life-satisfaction in Germany". Ecological Economics, 64, 787-797.

[12]. World Health Organisation (WHO) (2005). United Nations Road Safety Collaboration: A Handbook of Partner Profiles. WHO, Geneva, Switzerland.

[13]. Xiangpu, G. Ben F. Claire B. Yingxin C. John G., & Anna L. H. (2022). Association between noise annoyance and mental health outcomes: A Systematic Review and Meta-Analysis. International journal of Environmental Research and Public Health, 19(5),2696.

[14]. Zannin, P.H.T., Calixto, A., Diniz, F., & Ferreira, J.A. (2003). A survey of urban noise annoyance in a large Brazilian city: The importance of subjective analysis in conjunction with an objective analysis. Environmental Impact Assessment Review. 23, 245-25.