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Appraisal of Libraries in Niger State to Determine Their Location and Method of Construction for Noise Control Mechanism

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Abstract Libraries are required to provide quiet spaces suitable for studies and research. It is hence critical that noise is eradicated within the vicinity of a library. The concept of noise as an unwanted sound means that noise can exist anywhere and everywhere. It is ubiquitous in its existence and sources and thus can become difficult to tackle and control. The identification of noise sources is critical to effectively control noise. This paper examined some selected libraries of Niger State to identify the common noise sources within the Library spaces. The research enumerated them in order of increasing frequency using qualitative research method. The research revealed noise sources in Libraries of Niger state to be group study noise source in all libraries. It further revealed that impact noise and social chatter noise account for 90% of libraries, traffic noise source 40%, 30% with HVAC noise source while only 10% is generated from generating plant. The study recommended the provision of special reading rooms- escapist reading areas and group study rooms. It also recommended the need to anticipate future development trends around the Libraries with noise barriers to dampen noise from external sources.

Keywords Control, Frequency, Libraries, Noise, Sources

1. Introduction

Noise is generally regarded as any unwanted sound (Bell, Fisher, Baum, Greene, 2006; United States Environmental Protection Agency, 2012). Noise does not necessarily connote loud sounds and is not essentially random. Although loud random sounds are more likely to be unwanted due to their intensity, tone and quality, very few sounds if any can be said to be noisy or wanted. Under the right circumstance nearly, all sound can become noise (Bell *et. al.*, 2006).

A conversation between two people may be regarded as noise by someone who is not involved and is trying to get some sleep. Also, favourite music track played may be enjoyable to one and noise to another who is studying. The concept of noise is entirely subjective and can as such vary with individuals, circumstance, locality or environment and generally upbringing (Bell *et. al.*, 2006). Since the concept of noise as any unwanted sound is an entirely subjective issue, it can be deduced that noise come from anywhere. In other words, noise is almost omnipresent and so are its sources. This also by extension means its source can come almost

anywhere. There seems to be a wide range of noise sources that can potentially pose a lot of challenges to even the most benign of library environments (Herzan, 2014).

The location of libraries and materials used for their construction play significant role in the noise generated within reading environment. Individual differences and peculiarities among people make noise subjective. Two people in the same environment and same set of conditions may have divergent opinions on the same sound exposure. What may be too loud to one may be normal and acceptable to the other (Vinnik, Istkov, Balaban, 2011).

The circumstances or condition one is exposed to can vary the person's notion on whether the sounds perceived is noise or not. Noise has become an increasingly serious issue for libraries to deal with. It is pertinent to note that libraries require quiet environment as a matter of necessity (Zickuhr, 2013). A noisy library may lose patronage and ultimately, fail to live to one of its cardinal purposes of aiding study and research.

2. Literature Review

2.1. Types of Noise Sources in Libraries

Noise sources vary considerably in a library setting as its sources can result from almost anywhere. Noise sources can be classified by the location of its occurrence into internal and external noise sources.

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a. Internal Noise sources:

As the names connotes, internal noise sources are noise whose sources come from within the enclosed spaces of the Library. They are generated from within the library environment. They can either be structure borne-transmitted by the building structure- or air borne-transmitted by air. They are majorly generated from human activities within the enclosure. These include loud discussions, loud footsteps, door bangs. They can also be generated from building components and machines, vibrations from moving parts of equipment, electronics and Heat, Ventilation and Air Conditioning (HVAC) systems (Spring, 2008).

This type of noise source has profound effect on the people within the building and must be tackled adequately. It is important for designers and architects to anticipate these potential noise sources within the library.

It is also important to note that almost all internal noise sources are within the control of the occupants of the building and can effectively be managed by them. A vibrating air conditioner can be cladded or even stopped, the dripping sound from a running tap can be closed off, the whirring noise from a computer and its relevant accessories can be quilted, isolated, or turned off. It is possible in most cases to completely eliminate this type of noise source (Spring, 2008).

b. External Noise Sources:

This type of noise source is one that comes from the external environment of the Library. They are mainly air borne. The most significant of these types of noise sources are transport noise, pedestrian noise and background or ambient noise. It can also come from close by equipment and industrial type machines, generators or diesel operated engines.

A significant characteristic of this noise is that it is not within the purview of the built environment of the Library and hence is not under the control of the affected persons. Careful attention need to be given to the environment in which the library is located as well as the need to anticipate potential external noise sources and provide adequate protection from them. Some of these noise protection mechanisms from external noise need to be pre-emptive. More worryingly, these noise sources cannot be isolated but can be managed to avoid constituting a nuisance to library users (Spring, 2008).

External noise sources are typically possessive of all the three characteristics that make noise irritating and agitating to the affected persons- unpredictability, lack of perceived control and loudness or volume (Bell *et.al*, 2006).

NOISE SOURCES IN THE LIBRARY AUDITORIUM

1. Interactive or group study:

Library being a place where students go to find and seek information and other materials, the library also serves to provide a place where students can go and study subjects they are already learning while taking their course materials

with them (Blevins, 2000).

This often requires group discussion, group study, or interactive study. There is a growing preference for group study and interactive sessions to individual study (Bell, 2008). This preference for interactive study in place of traditional individual study generates a lot of noise within the library. It is important to note that interactive study should be a welcome development to library as it uses its vast available resources to properly facilitate group discussions. The academic library seems to be the most significant archetype (American Library Association, 2015).

2. Social chatter/ Escapist reading habit:

In an information age of several portable and handheld gadgets and electronic devices and several other wireless devices, it has become commonplace for millennial users- those born on or after the year 2000- to multi-task.

This new generation of library users frequently interrupt reading activities to pick a call, reply social chats, or even to play a video or a song! The traditional concept of studying for long uninterrupted periods hunched over books in Libraries does not appeal to millennial user and appear to make studies too laborious, boring and dull (American Library Association, 2015). The restrictions that are placed by most librarians as to the use of mobile devices feel too cumbersome and constraining to this category of users. There is also a growing leniency from Librarians towards noise as evidenced when they also engage in social chatter to wind down time. A lack of zoning of library spaces based on noise can worsen the noise from social chatter or activities.

3. Impact noise:

Impact noise is noise that occurs as a result of an object colliding with another. In a library, a door bang is a typical example of this noise source. This bang sound that is produced by a closing door disrupts user concentration, produces a heightened sense of awareness and a brief agitation to the Library users.

The absence of special door seals and sills, door closers and magnetic door locks contributes in no small measure in worsening the noise so produced. Instead of providing these special door features to prevent the noise, they have resorted to keeping the library doors widely open often times with the use of a wedge as a remedy, in the process allowing the ambient or background noise into the reading and study spaces of the library.

Another Impact noise source is on floors of buildings with more than one floor. Examples of these impact noises include footsteps over a floor, sliding of chairs and tables as one assumes a sitting position in the library or the dropping of anything on the floor from a height. When the impact occurs the sound becomes structure borne and is heard in the underlying spaces below it.

The absence of an acoustic ceiling below the concrete deck, a floating floor, or a noise resilient floor finish can further exacerbate the noise coming from this noise source (Pringle, 2013).

4. Traffic noise:

This is noise caused by Cars, trucks, motorcycle and other forms of mechanised transportation. This noise source has a significant effect on library environments first because as it is widespread in its area of reach and poses a lot of challenge in the built environment (Bell et al, 2006). Studies further show that it produces annoyance due to perceived lack of control over traffic noise by affected persons.

Another characteristic of traffic noise is that its noise levels are usually high. Noise from traffic typically ranges between 65-70DB. This is almost 16 times the noise levels acceptable within the vicinity of a library- 40DB.

5. Heat, Ventilation and Cooling systems (HVAC):

HVAC equipment typically consist of moving parts and rotating devices as well as air moving fans. These components have the potential to produce noise and vibration within the library space and can become both structure borne and air borne. HVAC is sometimes regarded as the ‘background’ noise inside a Library building. Controlling the noise at the source is the most effective means of combating HVAC noise as well as padding and dampening of the vibration (New York City Department of Environmental Protection, 2013).

6. Generators and other Heavy duty plants:

Generating plant and equipment produce very high noise levels. It typically produces between 80-100DB. When placed close to a library (say within a 50m radius), it can produce an almost deafening sound within the library-attenuation due to air resistance notwithstanding (E-noise control, 2015). This can lead to serious noise problems within the Library.

schedule was structured to assess the location of libraries in Niger State. The construction method and mterials used to control noise in libraries. There are 20 academic libraries, 4 state owned public libraries, and 1 national library in Niger State. This makes a total of 25 libraries in Niger State. (Niger state of Nigeria, 2013). Ten public libraries were selected at random by simple random techniques of probability sampling method. The selection of these libraries was done based on their location and materials used for their construction. The data was collected and analysed using descriptive statistical tools such as percentages and averages in a tabular format. The data were analysed using the SPSS and the Microsoft Excel Software for the computations.

The ten libraries selected are shown in table 1.

Table 1. Showing sampled Libraries

S/NO	LIBRARIES STUDIED	LOCATION
1.	IBB Library	FUT Minna, Gidan Kwano Campus
2.	Abubakar Gimba library	IBBU, Lapai
3.	Federal Polytechnic Library	Bida
4.	School of Nursing Library	Bida
5.	Niger state Polytechnic Library	Zungeru
6.	FUT Minna Library	FUT Minna, Bosso campus
7.	Yahya Madaki Library	COE Minna
8.	FGC Library	Minna
9.	Dr Abubakar Imam Library	Minna
10.	National Library	Minna

Source: Researchers’ field data, 2014.

4. Discussion of Results

The research examined the group/interactive noise sources, impact noise source, social chatter/escapist noise source, traffic noise source, HVAC noise source and Plant/Machineries noise source and the results are tabulated in table 2.

3. Research Methodology

The research method employed to carry out this study was the use of post occupancy survey research. An observation

Table 2. The occurrence of various noise sources in various libraries

LIBRARY	availability of group/interactive study room		noise resilient finish		escapist /outdoor reading area		vehicular traffic distance (<40m)		availability of door closers		HVAC noise		plant and machineries (<100m)	
	Yes	no	Yes	no	Yes	no	Yes	No	yes	No	yes	No	yes	no
IBB FUT minna	0	1	1	0	0	1	1	0	0	1	1	0	0	1
AbubakarGimba Lapai	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Federal Poly bida	0	1	0	1	0	1	1	0	0	1	0	1	0	1
School of Nursing bida	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Niger state Poly Bida	0	1	0	1	0	1	1	0	0	1	0	1	0	1
FUT Minna Bosso	0	1	0	1	0	1	1	0	0	1	1	0	0	1
Yayha Madaki Library COE	0	1	0	1	0	1	1	0	0	1	1	0	0	1
FGC minna	0	1	0	1	0	1	0	1	0	1	0	1	1	0
Dr. Abubakar Imam Minna	0	1	0	1	0	1	1	0	0	1	0	1	0	1
National Library Minna	0	1	0	1	1	0	1	0	0	1	0	1	0	1
Total	0	10	1	9	1	9	7	3	0	10	3	7	1	9
Percentage (%)	0	100	10	90	10	90	70	30	0	100	30	70	10	90

Source: Researchers’ field data, 2014.

The following are the common noise sources in libraries in order of increasing frequency.

- I. **Group/Interactive Discussions noise source:** The study reveals that none of the libraries studied had group study areas as tabulated in table 2. This absence of group study area creates a scenario in Libraries where users who are trying to take advantage of the vast resources in the Library to have group study disturb users who want to study quietly and individually. Since group study is a useful tool in learning, libraries need to make adequate provision for this category of users.
- II. **Impact Noise source:** As it can be seen in table 2, none of the libraries had any special protection from the banging sound on walls when doors are closed and are typically left open to avoid this noise source. This creates further issues as background noise enters into the library space unabated as seen in Plate 1. This typically produces an impulse sound that produces a heightened sense of awareness and

agitation to users, startling and disrupting concentration levels. It can similarly be revealed that 90% of libraries studied have no protection from impact noise on floors. Only 10% have resilient floor finish that protects the library from noise. This produces noise in rooms where the impact noise is produced and the room below the floor slab where the impact noise is transferred through the structure interrupted.

- III. **Social Chatter/Escapism noise source:** The result from table 2 shows that there is only 10% provision in libraries studied for escapist reading areas as seen in plate 2. This creates an avenue to spread noise to supposedly silent zones of the Library. The provision of this type of reading area, zones the noise typically produced by millennial users into special places that are designed to accommodate this type of reading habit. Outdoor areas, courtyards and atriums can also be harnessed to meet this need in existing Libraries as illustrated in Plate 2.



Plate 1. Showing open doors in Libraries with no door closers or special door sills (Source: Researchers' field data, 2017)

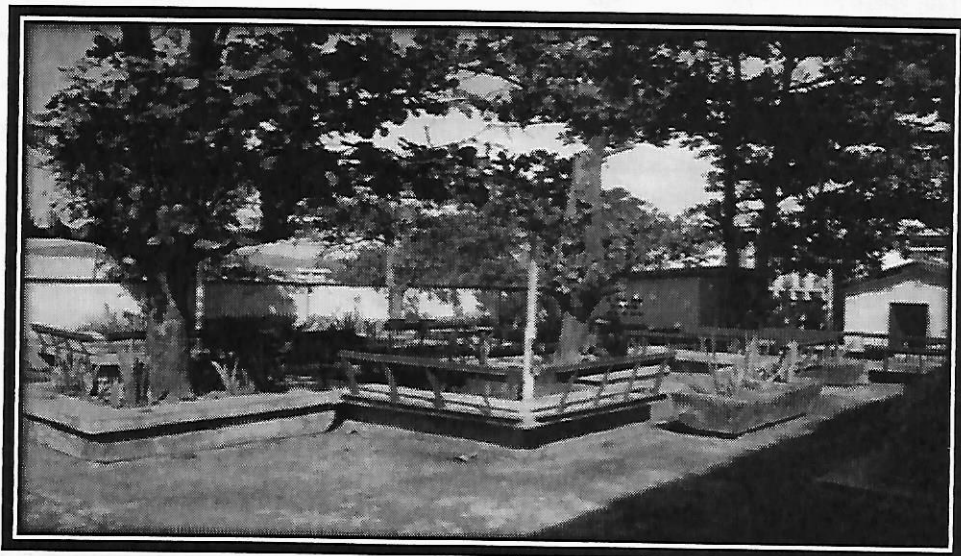


Plate 2. Showing outdoor reading areas for escapist readers and group chat (Source: Researchers' field data, 2017)

IV. Traffic noise source: The result as seen in Table 2 indicates that 40% of libraries studied have traffic noise sources while 60% have tackled this noise. Of the 60% that have tackled this challenge only 15% have used noise barriers with the remaining opting to use sufficient distance from traffic to attenuate traffic noise. The study also discovered that a traffic-to-library distance of 40m is usually sufficient to reduce noise by attenuation provided soft landscaping around the library vicinity. The remaining 40% as revealed failed to either provide sufficient distance or a solid noise barrier (continuous fence wall with good wall massing). This is also evident in Plate 3 where the Library is evidently too close to traffic noise with little or no protection. This thus means that the library is unable to effectively deal with this noise as it has no control over this noise source.

V. HVAC noise source: is often considered to be the interior ambient noise in a Library enclosure. Plate 4

shows that HVAC noise problem is only present in 30% of Libraries studied. 70% of Libraries have adequately tackled this noise source or have no such system in place completely as illustrated in plate 4; as with all ambient noise, the users of library gradually build a tolerance for this noise as long as it is continuous and predictable. However, where it is intermittent and unpredictable, it can be a source of serious annoyance and frustration to users and impairs concentration abilities.

VI. Plants and Machineries noise source: generating plants are generally laden with the potential to produce noise levels in excess of about 100DB. The study also reveals that generating plant noise is the least available noise source in the Libraries studied, with only 10% of them having generating sets closely situated to the library arena. The noise typically produced from generating plants can be deafening and needs to be avoided completely.



Plate 3. Showing Library too close to traffic noise with insufficient protection (Source: Researchers' field data, 2017)



Plate 4. Showing HVAC that can vibrate and create noise (Source: Researchers' field data, 2017)

5. Conclusions and Recommendations

5.1. Conclusions

Too numerous Noise sources in a Library can render a Library undesirable for use. It is important to make adequate provisions to eliminate as many noise sources as possible while planning a Library. This often requires an anticipation of future development around the Library's location and within its vicinity. External noise sources can only be managed and is almost impossible to eliminate completely as it is outside the control of the library. It is however possible to prevent this noise source from impacting on the library activities. Whereas internal noise sources can in most cases be isolated and completely removed from the library. Where this is not possible, they are still managed more effectively as they are well within the purview of the Library. The enforcement of social behavioural modification by library staff is increasingly being resisted by the users and is no longer an effective method of noise control in libraries. The study found the noise sources in Libraries of Niger State to be group/interactive noise source, impact noise source, social chatter/escapist noise source, traffic noise source, HVAC noise source and Plant/Machineries noise source in order of increasing frequency.

5.2. Recommendations

The following should be considered to combat external noise sources;

- There should be the use of city planning data to anticipate future development by acquiring data and facts through relevant planning authorities or from site survey reports to enable designers predict possible noise sources within the Library vicinity.
- There should be sufficient distance (at least 40m) is required from the traffic source.
- The use of generating plants around library spaces should be avoided while the use of inverters and batteries should be encouraged due to its quieter operation. Where this is not possible, sound proof quieter ones should be used.
- The generator rooms need to be attenuated to prevent noise from entering into the library. Duct silencers, sound proof panels, sound barriers should similarly be in place to further dampen the noise and vibration.
- There is the need to design Libraries that would adequately accommodate millennial users (with their escapist mentality) so as to properly zone out noise. This includes the provision of dedicated group study rooms, audio visual libraries, and escapist reading area instead of trying fruitlessly to ensure behavioural modification in the Library as is often the case in libraries. In existing libraries, well planned courtyards, atriums, outdoor spaces can be utilised to meet this provision.
- Impact noise on floors can also be a distraction. This noise source can similarly be removed completely from

a library by proper treatment using noise resilient floor finishes, use of floating floors, and ceilings below floor slabs where applicable. Sources such as door bangs need not exist completely in a library. The use of magnetic doors or door closers can completely eradicate this noise source.

- Clear cut demarcations need to be set for these social or escapist readers as well as providing a special reading area for them.
- It is very important to seriously consider traffic noise when planning a library and to anticipate future trend of development around the location of the library.

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