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## Building Design Practice and Fire Codes for Buildings in Nigeria (Issues, Effects and Solutions)

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### **Abstract:**

*Fire safety codes for buildings have been in existence over the years. The application of these codes in Architectural practice is questionable, due to the incessant collapse of buildings resulting from fire, which has led to the loss of several lives and properties. The need for adequate implementation of these codes in the field of building design and construction cannot be overemphasized. Most Architects are more concerned with the primary function and aesthetics of their building design, whereas equal attention should be paid to the safety of occupants. This is commonly associated with lack of incorporation of the fire codes in designs, hence making prevention of fire outbreak and rescue of occupants in the case of outbreak, difficult for fire fighters.*

*This research looks into the existing fire codes for buildings in Nigeria and its incorporation into building design practice, hence comparing those codes and their implementation with other existing codes, hence looking into prescriptive and 'performance based codes. The contrast between the codes and building design practice in Nigeria forms a strong base for this research.*

**Keywords:** Design practice, building code, fire code, compartmentation, fire safety, building design, building construction

### **1. Introduction**

The prevalence of fire hazards on buildings is currently an issue for all stake holders in the construction industry due to its frequent rate of occurrence. As such, equal considerations should be given to all building types, in order to adapt a system of safety approach for both public and private structures, which will effectively help to salvage the situation. In all building types both the passive and active fire prevention methods should be considered, Barnett .J (2002). All aspects of design such as architectural, structural, electrical and mechanical designs should be given relevance to safety codes and regulations. Haejun. p et al., (2004).

Worthy of note is that the contrast between fire codes and architectural design practice mainly results from inefficient use of the codes by professionals due to (i) Bulkiness of the code (ii) Access to the codes (iii) Ineffectiveness of law enforcement (v) Clients demand and affordability. These have consequently resulted to incessant fire outbreaks on a number of public buildings in Nigeria.

Notwithstanding, the National Building codes have been made available by the federal government of Nigeria, in order to set minimum standards on buildings, pre-design, design, construction, and post construction stages. This was done to ensure safety and proficiency in the building industry, due to incessant collapse of buildings, fire infernos, built environment abuses and other disasters.

However, the prevalence of fire hazards over the years does not justify the effective application of these codes. Some of the infernos experienced on public buildings over the years as gathered by the Nigerian Fire service includes; the Sango plank market Ibadan, the old Bida market in Niger where 600 shops were raised by fire, Ogunpa market fire which occurred January 16th, 2013, premium times, (2013).

In 2012 as recorded by federal fire service of Nigeria, 56 public buildings were raised by fire, premium times, (2013). Also, as collated by the Federal Fire Service, from January to December 2017, Nigeria recorded the highest number of fire incidents of 160 which includes 99 public buildings/government quotas. Leadership.ng (2017)

Furthermore, the world has witnessed the loss of many lives in both public and residential buildings as a result of fire outbreak, including the world trade centre (USA) inferno which incurred a property loss amounting to \$22.7 billion. PEPSPP(2009) Mostly public buildings have been affected by these outbreaks, resulting from inadequate implementation of fire codes on building designs and constructions. Hence, several fire preventive initiatives have been introduced around the world in an attempt to curb the prevailing cause of fire occurrence, some of which includes sensitization of the populace on community base programs, education training for students in schools and most importantly, the introduction of building codes and regulations for design and building constructions.

It is on this premise that this research seeks to focus on Nigeria's fire code in relation to its application by professionals.

## 2. Fire Codes for Building Designs

Essentially, fire codes for building designs are a collection of regulations adopted by a city to govern the design and construction of buildings. They are basically classified into two; Passive fire control systems and active fire control systems Barnett, J. (2002). Passive fire control system deals with the aspect of design and construction of buildings which puts into consideration safety applications such as means of egress (escape route), compartmentation, access for fire fighters and materials. Worthy of note is that, compartmentation is key when it comes to passive fire control systems in public or residential buildings because it makes provision for area of refuge for building occupants, thereby making it easy for fire fighters to access and exit the building for easy evacuation of occupants and properties. compartmentation allows for the prevention of vertical spread of fire, e.g. occupants on the next floor or apartment to escape during a fire outbreak. Similarly, the use of compartmentation is very effective when it comes to the horizontal spread of fire. The codes serves as a guide for design application for passive fire control systems. According to the Nigerian National Building Code, (2006), are as follows;

### 2.1. Compartmentation

The National building code states in section 7.1.1.3 the separation of occupants in fire resistive construction, either vertically, horizontally or both.

### 2.2. Materials

"Section 5.3.1.1 of the National building code states that steel, iron, concrete or masonry shall be used as type 1 fire resistive building material".

### 2.3. Means of Egress

Means of egress are to be provided in every fire resistant structure leading to an open space whose access is directly to a street ( section 7.3.3.1)

Active fire control system on the other hand has to do with the post design stage which includes the use of sprinklers, smoke and fire detectors, fire extinguishers and fire alarms. It is considered as a means of fire suppression and can function either manually or automatically. Manual means of fire control depends on humans in order to function while automatic means of fire control are programmed to operate by themselves as soon as there is a fire incident. For active fire control, the National building code states as follows;

### 2.4. Sprinkler Systems

Sprinkler systems are also to be provided in every fire resistant building, designed and provided for every floor constituting a water floor device and shut off valves. (section 5.3.7.2)

### 2.5. Smoke Control

Section 5.21 states that an air system which is mechanically operated to emit air, must be installed, and the opening of the exhaust located in a smoke trap area of an atrium.

### 2.6. Alarms

Section 5.3.7.10 states that fire alarms with communication systems must be installed in every floor of all tall buildings.

## 3. Performance and Prescriptive Based Codes

A performance code requires that a building as a whole performs to a certain standard, whereas a prescriptive code requires that each component is built to a certain standard. Most countries make use of "performance base" codes. This is because performance based codes are considered more effective and flexible in terms of application. H.Z Vischer, (2003). The nature of the code makes it possible for professionals to have an advantage of individual cognition which may influence the cost of construction of a given design and adoption of change in technology.

However, the Nigerian National building code is prescriptive. Hence codes for fire and other aspects of building are not quite flexible. For example, areas of refuge otherwise known as compartmentation are recommended for design in

the National building code. This can serve as alternate to the automatic sprinkler system". Section 5.3.7.10, National Building Code, (2006).

But such compartmentations must conform to the following, as stated in section 5.3.7 of the National building code:

- Each storey may be divided into more than one areas of same size and non-should exceed 139m<sup>2</sup>.
- Each compartmentation shall be constructed with one lift, leading to the main floor and a minimum of one enclosed stairway at the exits.
- Flame barriers are recommended on floors that are vertically adjacent to one another at exterior walls of within 1.5m horizontally.
- Such walls above are required to have a fire resistance rating of two hours minimum. Such walls are to be caulked with non-combustible and impervious materials.

The code emphasizes on complete separation of occupants in fire resistive construction. A performance based code is otherwise flexible for design cognition and makes room for easy adoption of change in technology by professionals.

#### 4. Compliance to Building Fire Codes

The contrast between the code and design practice mostly results from non-adherence of the codes by professionals. Sometimes the designs are made complex such that functional flow is not easily understood by the occupants, especially in the case of public buildings where the occupants do not dwell. For example, in shopping malls where the activities, basically have to do with buyers who only come once in a while to make purchases. Complex floor plan that does not adequately explain itself will make it difficult for occupants to easily exit the building in the case of fire outbreak, or for fire fighters to identify access for prompt evacuation of occupants O' Neill, (1991).

However, the ineffective implementation of building/fire codes could lead to building collapse, Inadequate planning of towns and cities, use of substandard products and untested materials and lack of hazard considerations in design process by professionals.

These codes are aimed at achieving standards in building construction from design stage to post construction stage, in order to ensure safety in the Nigerian construction industry. Hence the inadequate implementation could also lead to poor Standard Specification (SS) as ascertained by the findings of Florunso and Ahmed, (2013). The non-compliance to SS in Nigeria has resulted to frequent replacement of materials, high cost of maintenance, poor performance of building components among others.

Similarly, Shingo, (1988) and Abdusallam et, al.(2014) stated that non compliance to SS has resulted to waste of materials, time, resources and poor execution of construction works. It is to this effect that there is need to pay more attention to the existence and implementation of the Nigerian National building code in design and construction which will consequently address the issues surrounding standard specifications and quality control in the building industry Kabiru, (2018).Essentially this could go a long way in reducing fire hazards.

#### 5. Conclusion and Recommendation

Fire codes for buildings are meant to help professionals in the construction industry to ensure a safety compliant design and construction of buildings which puts into consideration, the available fire prevention systems which are mainly passive or active. These two systems of fire prevention and control are adequately captured in the National building code of Nigeria. This study therefore, identifies the following as factors impeding the application of these codes which has lead to incessant fire outbreak in the country:

- Inadequate law enforcement
- Cost implication
- Clients demand and affordability
- Lack of fire safety culture in Nigeria
- Bulkiness of the code (mixed with the Nigerian building code)
- The codes are prescriptive in nature

The general conclusion of this research reveals that there is a contrast between professionals and architectural design practice for fire codes and application. However, the need for Architects to pay more attention to fire codes and application is necessary. Awareness of the existence and application of the codes should be raised by the help of training session from architectural schools and other related fields especially.

Also, the need to adopt a performance based code is necessary due to the adverse change in technology as this will give professionals an ample opportunity to proffer solutions based on their own design cognition which would conform to change in technology and make room for cost control in order to meet clients demand.

The table below shows the advantage of performance based code over prescriptive based code.

Performance Based Codes		Prescriptive Based Codes	
1	Quite flexible for design cognition	1.	Rigid in nature
2	Can easily blend with the international code because the international code is also prescriptive in nature.	2.	In contrast with the international codes
3	Cost effectiveness	3.	Quite expensive
4	Makes room for change in technology for fire safety.	4.	Prescriptive fire may be in contrast with new technology
5	In performance based codes fire safety objectives are stated clearly hence, architects and engineers are free to devise their own means of attaining fire safety objectives	5.	There are restrictions to how much a designer can contribute in terms of cognition.

Table 1

The need for having fire codes and regulations separate from the national code is highly essential, as it will help reduce the need for Architects to read through the whole national codes trying to find the sections for fire safety, hence making the design process more tedious and tasking. Furthermore, the need for periodic review of the constitution is also necessary as there is always an improvement in technology. The periodic review of the codes will help in making better provision for safety, in line with change in technology.

Finally, existence of codes without enforcement will definitely nullify the effectiveness of the codes. The need for adequate enforcement of fire codes is highly essential at both federal and state levels as this would help to achieve a fire safe design of buildings for occupants through checking and making approvals of drawings based on safety conditions and ensuring periodic inspection of fire fighting equipments and installations. Also, the Nigerian fire codes are mostly prescriptive in nature. Hence a performance based code may be more ideal in order not to restrict architects and other professionals in the construction industry from making research and implementation in the area of fire safety.

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