

## FIRE PREVENTION IN RESIDENTIAL BUILDINGS IN NIGERIA: ISSUES AND RECOMMENDATIONS

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### Abstract

*Fire outbreaks in public buildings have become a major concern in Nigeria in recent times. There have been several reported cases of fire incidents in public buildings where lives have been lost, and properties and goods worth millions of naira have also been destroyed. The paper discusses some fire outbreaks in some residential buildings in Nigeria with the view to examine fire preventive measures and proffer solutions on the need to improve proactive fire preventive measures through passive as well as active measures. It further notes that a consequence of the interplay of non-adherence to fire safety measures in the design of residential buildings has been a major contributing factor that encourages fire outbreaks. It also pointed out that poor management and lack of maintenance culture have vastly contributed to major fire outbreaks. The methodology involved the qualitative approach and data was collected from the following secondary sources: published journal articles, media reports, scholarly studies on fire prevention, gazetted documents on fire codes, building codes, and other fire prevention documents. The findings of the paper show that even though no one can predict fire outbreaks in residential buildings when concerted efforts are put in place at the design stage of the building and the application of specified fire-rated building materials, it would go a long way in preventing fire outbreaks. The paper further concludes by encouraging adequate maintenance of fire apparatus and accessories installed in buildings and encourages advocacy on the use of approved fire resistance materials on public buildings while ensuring synergy with relevant fire authorities on the changes made to fire-rated materials on public buildings for effective preventive measures in the event of fire outbreak.*

**Keywords:** Fire outbreaks, Fire prevention, Fire safety measures, Residential buildings

### INTRODUCTION

The need to have proactive plans and preparedness in the prevention of fire in residential buildings has become a major concern to all stakeholders, residents and professionals in the built environment. There seems to be a neglect of the need to take proactive measures on passive ways of first prevention in residential buildings and such has been reflected in the series of fire outbreaks that have been reported in various news outlets.

The conflagration of fire occurs when a combustible material in combination with an oxidizer like oxygen is exposed to a source of heat above the flash point for the fuel and can sustain a rate of oxidation that produces a chain reaction (Yusuf, 2012; Adekunle, Ibe & Imonikosaye,

2018). The depressive evidence of reports on the incessant outbreak of fire incidence in residential buildings is thought-provoking and further raises questions if there are fire design considerations in the planning stage of buildings. However, several causes may be attributed to the causes of fire outbreaks in buildings such as negligence over flammable sources, especially kitchen gas cookers, non-repair of faulty electrical appliances, non-control of electricity surge in buildings and improper disposal of flammable waste amongst others. According to various studies (Makanjuola, Aiyetan & Oke, 2016; Sebastian, 2021) on fire outbreaks, so many properties and many lives have been lost as a result of fire outbreaks and this shows the need for more sensitization on fire prevention in residential buildings.

Therefore, the need to protect buildings, lives and other properties against fire outbreaks should be an utmost priority of relevant stakeholders. Jing and Chongfu (2013) studied fire risk analysis in residential buildings and opined that one of the best ways to manage fire outbreaks is to build fire risk analysis which is supposed to be a fundamental threshold for managing fire. While the fire risk analysis is a significant factor for consideration, there are yet a lot of research-based actions needed to reduce the menace of fire outbreaks to the bare minimum. Furthermore, a lot can still be done to mitigate the scourge of fire outbreaks so long as concerns on fire prevention are at the fore during the planning, design, construction and post-construction stages of buildings. Furthermore, other causes of fire outbreaks such as negligence to installations that are prone to ignite fire quickly or that can accelerate the spread of fire, improper disposal of flammable waste and fire-related activities can be major catalysts for conflagration. Passive methods can be adopted by relevant authorities in fire prevention such as fire sensitization programmes, fire safety education and workshops can be organized for targeted audiences and occupants of residential buildings which can equally add value towards the mitigation of fire outbreaks.

The residential building is the most important building type in any human settlement, as it constitutes the best possible conducive environment to achieve comfort levels for the overall health and productivity of occupants (Adaji, Adekunle, Watkins, & Adler, 2019). Harkouss, et al., (2018), opined that people spend up to 90% of their time inside buildings, so the quality of their indoor environments has a significant impact on their quality of life. The utility of residential spaces is the function of their spatial comfort and their capacity to sustain occupants to escape in case of a fire outbreak (Adunola & Ajibola, 2016). The building design standards and configuration are important interrelated components, consistent with the efficient performance of the elements in buildings.

The built-environment burgeoning fire incidence has occurred virtually across all infrastructural facilities, residential buildings, commercial buildings, and automobiles. Even bush burning and fire caused by oil spillage across the continent have been a challenge for researchers in addressing the fire outbreaks debacle. According to a report from National Park Service (2023), three elements must be involved before the fire can ignite. The triangulation between oxygen, heat and fuel are the necessary ingredients that could ignite most fires. In the alternative, the prevention of fire can equally be achieved by removing any one of the three elements that can ignite fire. Hence acute ignorance of the interplay between the three elements of sources of fire ignition may adversely result in combustion. This study aims to

investigate the passive ways of fire prevention in buildings with the view to examining the proactive measures towards ameliorating incessant fire outbreaks in buildings. The objective of this study is to examine reports of some fire outbreaks in residential buildings to understand the gaps in passive ways of fire prevention and the need to reduce incessant fire outbreaks in buildings. The scope of the study covers the passive and active preventive measures for mitigating fire outbreaks in buildings with an emphasis on the concerted roles of relevant stakeholders.

## **LITERATURE REVIEW**

Studies (Obasa, et. al 2020; Oloke, et. al 2021) have shown that most fire outbreaks in residential buildings often emanate from beds, sofas, flammable furniture, and clothing. Adebayo, et. al (2018) noted that fire incidence has recorded a higher rate of fatality of more males than females, with a higher fatality rate for elderly than the younger people. Sadly, whatever comes under fire outbreak is usually destroyed depending on the rate of the conflagration except for some fire-rated materials which have also been experienced in other infrastructural facilities such as schools, Markets, Churches, Mosques, Banks and even Automobiles. The basic understanding of the nature of the conflagration of fire is very crucial to note that preventive measures should be paramount before the relevant stakeholders of various facilities that are open to the public to curb the menace of unexpected fire outbreaks.

Understanding the characteristics of fire and the nature of behaviour through channels that can easily ignite fire and materials that can aid the spread should help devise and develop various strategies, plans and programmes for the mitigation process. Fire outbreaks can be propelled through natural occurrences such as climate change and man-made causes. In the Nigerian context, the obvious need to tackle the problem of fire incidence cannot be far-fetched given the rate the extensive loss of lives and properties. Some authors (Agbonkhese et al, 2017; Agbola & Fashola, 2021; Arewa et al., 2021) in various studies revealed that negligence and carelessness on the part of residents is a major cause of fire outbreaks. Also, the lack of poor road network & lack of communication infrastructure has equally contributed to the need to prevent fire spreading while other active fire preventive measures were advocated to be adopted in buildings such as automatic sprinklers, standpipes wet risers, occupants and firefighters' voice communication apparatus.

Fire outbreaks in residential buildings are a huge task to contain. There is a need for serious and sustainable design strategies to be adopted to ameliorate the rate of the spread. The way of evacuation of individuals is a major point to consider in the planning and design aspects of buildings. Margrethe, et al, (2010) emphasized that it appears the provisions of the law do not always provide the support people need when buildings are on fire. Therefore, Sabastine (2021) advocated the need for the introduction of smoke alarms in public buildings with the view to improving fire safety and reduction of fatalities to enhance the smooth evacuation of occupants in the event of a fire outbreak. Contributing to the measures to enhance fire safety measures to prevent fire outbreaks in residential buildings, the need to educate residents on fire safety protocols, and the enacting of laws for fire safety equipment in homes were

recommended (Daramola & Ibrahim, 2021). It further posited that the incidence of fire outbreak cannot be completely eradicated but the need to adopt mitigating factors should reduce the incidence to the bare minimum.

This mitigating measure was also corroborated by Enrico (2021) that elderly people are a high-risk group when there is a fire outbreak in homes and advocated the installation of a smoke detector as well as emergency egress for quicker evacuation during an outbreak of fire. Fire resistance materials have been documented in the extant literature with standards of various fire-rated materials with the period of resistance of fire to give room for evacuation and putting out. According to Angus and Luke (2020), the statutory guidance recommends 30 minutes as a period of fire resistance for offices and residential buildings in the United Kingdom. Therefore professionals in the building industry are always expected to acquaint themselves with the fire resistance materials and resistance durations in their various localities when specifying building materials in their designs to enhance passive ways of fire prevention. In other to maintain fire preventive measures in buildings, certain considerations should be put in place during the design stage, this may require the installation and use of heat-producing and energy-consuming devices as well as safety operations that may involve the hazard of ignition (Isiwele, Adamolekun & Akhimien, 2017). According to Isiwele, Adamolekun and Akhimien (2017), the three major causes of fire in residential buildings can start from malfunctioning equipment, misuse of heat sources and human error. Hence, in the event of a fire outbreak, the objective of fire prevention is therefore to reduce the possibility of fire starting in a building. One of the major causes of fires and casualties is to lack of fire safety management capabilities, a lack of public awareness of fire safety and a lack of evacuation strategies (Zhou, 2017). Most households do not attach importance to awareness of the safety and fire safety of residential buildings, which sometimes usually leads to fire hazards.

Fire is useful to man either for domestic purposes or for the burning of debris. It can also be seen as a servant but can also be the worst master that can be difficult to control when it turns into a conflagration (Adenkunle, Umanah, Ibe & Imonikosaye, 2018). Fire has destroyed several properties in Nigeria from public buildings and residential, educational buildings, automobiles, markets, gas facilities, hotels, and restaurants. The lessons to learn from the destruction of properties by fire is to understand the cause of the fire containment of conflagration and prevention. It is also apt to ensure the provision of active fire prevention equipment such as fire extinguishers, drenchers, water hose reels, sprinklers, buckets of sand and other fire fighting apparatus at residential buildings to help prevent possible fire outbreaks and to contain it from spreading before the arrival of the fire brigade. It is very important to note that early detection of fire at any point in time is a very vital step to take, advocacy and sensitization to the public is equally important to ensure that the public is educated in preliminary fire preventive measures.

### **Fire Design Consideration**

Due to the menace of fire outbreaks in buildings, proactive measures are very important to be considered during the design stage. Concerted efforts to contain and curtail the level of

conflagration should be paramount in the minds of relevant professionals in the built environment. Alley (2021) posited some of the passive measures of fire design considerations as compartmentalisation of buildings through the use of the fire resistant walls and floors, provision of emergency exit routes, evacuation lighting, and provision of fire dampers, fire doors, fire walls, smoke barriers and shaft enclosures. Other passive methods include the use of fire-rated materials and non-combustible materials for finishes in buildings.

It further contributed that other active fire protection measures that require manual actions within the residential environment are also very important in fire prevention which are; the installation of sprinkler systems, fire hose reels, installation of fire hydrants, fire alarms and detection systems, standpipe risers, and provision of fire extinguishers. Active fire prevention measures require the installation of gas leakage alarms at residential homes, evacuation gas masks, fire blankets and lighting protections.

### Incidences of Fire Outbreak in Nigeria

In Nigeria, the extensive loss of lives and properties from incessant fire outbreaks is indicative of some obvious need to tackle the problem of fire incidence. Daramola and Ibrahim (2021) noted that residential buildings frequently go up in flames basically as a result of inadequate fire safety awareness in the country. The culture of fire safety is yet to take root here as a panacea to frequent and deadly house fires; a situation also noted by Zhou (2017) in some parts of China. Most homes in Nigeria are not equipped with fire safety equipment that can detect fire outbreaks at early stages. Worse still, high-rise buildings are springing up in the country which is growing a concern.

A cursory survey of reports on the fire outbreaks within Nigeria is worrying. The preponderance of the aftermath of the fatalities and destructions as a result of the inferno calls for a stronger role for relevant stakeholders in the built-environment intervention for sustainable preventive measures. Reports from the literature have attributed the cause of fire outbreaks to so many factors. that notwithstanding, the need to adopt professional measures to passively and actively prevent fire outbreaks remains a relative solution to adopt at all levels of the life cycle of combustibles. This study advocates for a more holistic categorisation of different aspects of fire outbreaks based on the compilation of data on residential buildings, highlighting the apparent causes of the fire outbreaks and possible militating factors to forestall further occurrence. Table 1 below shows a brief and random report on fire outbreaks in Nigeria.

**Table 1: Randomly Selected incidents of fire outbreaks in Nigeria**

S/N	Year	Facility	Location	Disaster	Causes
1	Jan 2023	Internal Displaced Camps	Bornu State	9-facilities	Burning garbage near camp
2	April, 2023	Residential building	Diobu Port Harcourt,	Properties destroyed	Unknown
3	July, 2023	Residential building	Ondo State	Properties destroyed	Unknown
4	October, 2023	3-storey commercial building	Lagos State	Properties destroyed	Unknown

5	November, 2021	Residential Building	Port Harcourt Rivers State	Goods properties destroyed	and	Arson
6	December, 2022	Residential building	Port Harcourt Rivers State	Goods properties destroyed	and	Kerosene explosion

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### **Issues in Fire Prevention in Buildings: The Architect's Role**

There is a need for architects to be very mindful of preventive measures for fire outbreaks during the planning and design stage of buildings. This is very important because the architect is one of the prime professionals involved in the production of drawings that would be eventually used by other allied professionals to have a complete working drawing. The designing, specifying and spatial organisation of buildings that meet the minimum fire requirement with the view to promote occupants' safety and protection of properties is one of the numerous duties of an architect as the master builder. The architect should be able to be conversant with the relevant building codes which are replete with the minimum requirements and standards to safeguard the safety of the lives and properties of the occupants. By so doing the codes should guide the architect, especially in the preparation of specifications, building design classifications, building materials requirements, and environmental requirements. The architect should equally be conversant with the provisions of the extant National Fire Safety codes with the view to be updated on the various aspects of fire preventive measures that would guide in the designing and specifications and fire protection requirements.

The architect should be able to have a fire strategy plan during the design stage of a project with the view to understanding how fire can be prevented in the proposed building. According to the Federal Republic of Nigeria (2006), every building is classified according to use, occupancy and type of building in line with the fire code enforcement and as such, the architect should be able to be guided by such classification to be equipped in making sound design decisions. The architect is equally expected to understand the characteristics of fire-resistive building materials and non-fire-resistive building materials with the view to be guided in the design stage.

The occupancy load factor should be a major consideration in the design stage to determine the means of egress into facilities, size of staircases, number of exit doors, passageways and travel distances. Other roles of the architect in passive fire prevention during the design stage further entail the consideration of compartmentalisation of spaces, emergency external exit stairs, and specification of fire doors, and windows, with other fire-rated building materials and fire dampers. Architects should also be abreast with the characteristics of means of egress through the specification of exit access ramp, height of escape routes, stairway doors, remoteness of exit points, number of exits and penetration around exit routes.

## **CONCLUSION AND RECOMMENDATIONS**

The context of this paper was the examination of fire outbreaks in residential buildings in Nigeria. The possible causes of fire outbreaks were discussed and some of the factors that accelerate the conflagration of the spread of fire were identified. It is the position of this paper that since a fire outbreak can occur at any time, there is a need to apply the passive measures of fire prevention as well as the active measures which when properly applied will reduce the incessant fire outbreak to the bare minimum. Therefore the passive and active measures of fire prevention were discussed as well as the documentation of some fire outbreaks in Nigeria. Consequently, the following recommendations are made:

Professionals of the built-environment should properly be educated with relevant building codes, and fire codes and apply them where necessary in the design stage of buildings, these would ensure that all the necessary passive preventive measures are accommodated in the working drawings and also ensure that all the specifications are implemented during the construction stage. There is also a need for the management of residential buildings to continue to engage qualified construction companies and specialist contractors during the construction stage and also to maintain standards by the relevant building regulations, and fire codes as regards fire-rated building materials in Nigeria. To sustain deeper preventive measures, stakeholders need to routinely educate the occupants of residential buildings on the need to operate basic fire fighting apparatus in the buildings, taking this part will limit the rate of spread of fire outbreaks. It is also recommended that the authorities in the fire department routinely organise seminars and workshops for professionals in the built environment on the continuous professional Development Programme (CPDC) on fire preventive measures. It is also recommended that relevant fire codes and building codes of countries be updated whenever necessary due to the ever-changing technology in construction and building materials and also due to the attendant effects of climate change.

To further corroborate the recommendation, fire preventive apparatus and accessories should be checked and maintained routinely by the relevant professionals to ensure optimum performance in the event of a fire outbreak. The findings put a premium on stakeholders' systems of residential buildings to adequately update the fire department of their localities whenever there is a renovation that requires the replacement of some fire-rated and other fire safety installations and building materials to guide the fire brigade to be proactive in fire fighting. Furthermore, the government should synergize with other relevant stakeholders in promoting national fire safety education, and sensitization on residents to create awareness of fire prevention measures.

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