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Assessment of Active Fire Prevention Strategies in Bells University Senate Building

Abass Abideen Dare, Oyenuga Ayomide Olusegun, George Joy-Berachah, Ajayi Daniel Oluwatobi, Tonibor Egbebra Taiwo, Olakunle Solomon Oluwakayode, Adeniyi James Adejinle.
Department of Architecture, Bells University of Technology, Ota, Ogun State, Nigeria.

Abstract:- Records of fire incidences has been on a high increase lately with huge loss of lives and properties which thus call for an assessment of the prevention strategies. An active fire prevention system is a dormant system that needs to be activated in the case of a fire to perform its function This study focuses on assessing active fire prevention strategies in Bells University Senate Building. A Senate Building is the core and administrative sector of the university. It houses the university council and senate chamber and other offices. Descriptive research is employed in this study using a well–structured questionnaire and on-site observation as sources of data. Data obtained were analyzed using statistical analysis presenting identified active fire prevention strategies present in the case study area and how effective they are. Results from this study show that the Senate Building is not well equipped against fire. This study recommends that the management of the institution equip the senate building with the recommended active fire prevention equipment such as; fire alarms, sprinkler systems, hose reels**, exit signage, heat detectors, and emergency lightings.**

Keywords:- *Active Fire Protection, Bells University, Senate Building, Fire Safety, Fire Protection System.*

I. INTRODUCTION

Buildings constitute majority of physical infrastructures and play an essential role in a nation's socioeconomic development. (Krausmann F., Wiedenhofer D., Lauk, C., Haas, W., Tanikawa, H., Fishman, T., & Haberl, H., 2017). The administrative portion of the university is housed in a senate building. Along with other offices, it houses the university council and senate chamber. Building fire hazards are those that could endanger people's lives, the building's structural integrity, and its possessions. The severity and adaptability of fire hazards in buildings have significantly changed as a result of the world's rapid development, and they have recently grown in importance (Kodur V., Kumar P. and Rafi M., 2020).

Bells University Senate building is a single floor building located at the heart of the university community. Red bricks are the predominant building material used with louvre windows.

Plate 1: Bells University Senate Building. Source (Researcher's Fieldwork, 2022)

A few decades ago, fire outbreaks were considered as natural disasters and as such, with little consideration for other factors. Along with the population expansion, the frequency and severity of loss in life or economic damages have been rising.

A dormant system called an active fire protection system must be awakened in the event of a fire for it to work (activation of water spray systems, deluge systems, sprinkler systems, fire water monitors, and steam rings around flanges). The two types of active fire protection strategies are oxygen reduction and fire detection and suppression.

Fire safety is defined as a collection of procedures for preventing or delaying the occurrence of fires, controlling their spread and consequences, and minimising whatever damage they may cause. To put out a fire, active fire protection takes action. The initial lighting of a fire will be resisted or stopped using passive fire protection. They cooperate by warning occupants of the building that a fire is present and safely controlling it so that people can leave or attempt to douse the flames (Buchanan A. H., & Abu A. K., 2017).

II. LITERATURE REVIEW

For people in a wide range of vocations, working in an office setting such as Bells university senate building is fairly frequent. Given that many individuals spend their days in offices, it is crucial to think about fire safety in the workplace, particularly with relation to offices.

A. Common Fire Hazards

The suppression of flames is a significant component of fire safety. Electrical distribution, flammable, and combustible materials are the main causes of fires in offices. The causes of many workplace fires are similar. Understanding the common fire dangers can aid in preventing fires from occurring. So, the following are the main hazards to watch out for in office buildings:

- "Electrical equipment such as photocopiers, not being maintained properly (electrical faults are a major cause of fire), faulty wiring, overloaded circuits, poor connections, blown fuses, uneven electrical loads, and many more, which can cause overheating or sparks that start a fire.
- Paper, card and other flammable materials being stored inappropriately, e.g. under desks, or next to electrical equipment.

B. Active Fire Prevention Systems

One of the most crucial factors to think about and plan for when constructing any kind of modern facility is active fire protection. Active fire protection has undergone significant advancements in recent decades, with systems becoming more sensitive and outfitted with cutting-edge technology to ensure optimal effectiveness. As a result, there have been less serious indoor fire-related events globally over time, making it safer and more secure for contemporary individuals to live, work, and shop there. Alarms and sprinkler systems are the two types of fire safety that most people often consider. However, Active Fire Protection (AFP) actually encompasses a lot more; these systems operate to identify, warn about, manage, and suppress or put out a fire (Kącki M., Vives Muñoz G., Mughal S., & Kułakowski A., 2018).

A building or structure is protected from fire using active fire protection techniques, which rely on the movement of moving parts. Both manually and automatically operated equipment, such as a fire extinguisher or sprinkler, are necessary for these systems to function. (Buchanan A. H., & Abu A. K., 2017). The presence of fire and/or smoke inside a structure can be determined using fire/smoke alarm systems. Sprinkler systems are employed to aid in containing the spread of the fire (Poon, 2013). Firefighters and fire extinguishers are both employed to help completely put out the fire.

Systems that entail a triggered response to a fire are referred to as active fire protection systems. The flame activates active systems, and the response can be manual (a hand-operated fire extinguisher counts as an active response, for example) or pre-programmed (for example, a sprinkler system).

These devices are thought of as a proactive method for putting out flames and limiting the spread of smoke.

Fire detection and fire suppression are the two main categories that these measures fall under (Kodur V., Kumar P. and Rafi M., 2020). As implied by the names, one of these categories refers to actions intended to alert people that a fire has started, while the other is concerned with actions intended to guarantee that it is put out fast and effectively.

Oxygen reduction is a further parameter that is not compatible with either of these classifications. Hypoxic air systems, also known as oxygen reduction systems, are typically installed as a preventative precaution rather than to identify or put out a fire.

C. Active Fire Prevention Strategies

1. Fire alarm

Fire detection and alarm system offer a way to automatically detect fire and notify building occupants of the danger of a fire. The signal to start the evacuation of the building's occupants is the auditory or visual alert given by a fire detection system. This is crucial in large or multi-story buildings where residents might not be aware that a fire is happening inside the building and where it is unlikely or difficult for someone to give them a warning.

2. Sprinkler System:

A sprinkler system consists of pipes along the length of the ceiling that hold water under pressure and another water supply for a steady flow. Automatic sprinklers are positioned at specific areas and attached to the pipes. A seal in the sprinkler head ruptures during a fire at a predetermined temperature, releasing a constant stream of water.

3. Hose Reels

Fire hose reels are put in strategic locations to offer a manageable and accessible supply of water to put out a potential fire risk. They are perfect for sizable, high-risk situations like hotels, factories, and schools, etc. Thirty metres of 19mm and 25mm hose can be found on hose reels. With automatic or manual valves, hose reels come in fixed, swinging, recessed, and concealed forms.

4. Break glass

The Exit Break Glass is intended for use with centrally controlled fire detection systems. The circuit immediately shuts off when the glass is pressed firmly or cracked, and it can be utilised for both open and closed circuits. It's difficult to top a typical broken glass key box for an instantly recognisable means of escape if your fire door demands a key. The soft glass is made to break easily when pressure is applied to the panel with the hand or fingers. After the glass is shattered, the doors will still be open. It offers a speedy means of evacuating or escaping while keeping you safe.

5. Heat Detectors

A particular sort of detecting system whose sensor element is a metal that typically melts at 70°C/158°F might be referred to as a "heat detector." Based on its working

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principle, which involves a pressurised airline in which the fuse plugs are inserted to monitor a particular area, this system is known as a fusible plug system. The pressurised airline experiences a fast pressure drop as the air is released by the fuse plug itself after it has fused if enough heat is produced to melt the metal of the fuse plug. The sensor notices this drop in pressure, and a signal is produced for alarms and postfire confirmation procedures. Heat alarms are not sensitive to smoke, but they do detect a rise in temperature brought on by a fire. They can be used in a kitchen, garage, or dusty area, but they shouldn't be the only fire detection method.

6. Smoke Detectors

A smoke detector is an electronic fire protection equipment that detects smoke on its own, a vital sign of a fire, and emits a warning sound to the residents of the building. The process of detecting smoke in a fire is crucial. The majority of camera-based fire detection techniques integrate flame and smoke detection techniques. Colour and motion data are used in smoke detection techniques to identify smoke in digital photographs. Additionally, smoke detection reduces the likelihood of false alarms. Smoke has an odd hue with a lot of blue saturation.

7. Fire Blankets

A fire blanket is a piece of fabric-based firefighting apparatus that can be used to contain or put out small flames since it is fire-resistant. Fire blankets can aid in suffocating and putting out fires. They can be particularly useful when a person's clothes catch fire and are simpler to use than other fire protection tools.

8. Portable Fire Extinguisher

By definition, a portable fire extinguisher is a piece of apparatus used to put out a fire. Extinguishing agents are released by portable fire extinguishers in order to cool the fuel, eliminate or displace the oxygen, or halt the chemical reaction. Until assistance arrives, fire extinguishers can put out or control a fire.

9. Exit Signage

The locations of a building's exits are crucially disclosed by fire exit signs. If there is a fire or other emergency on your property, they could assist save lives. Fire Exit Signs are typically green and white in colour and include directional arrows to show which way to go. Finding the closest fire exit is made easy with the help of fire exit signs.

10. Emergency Lighting

When typical electrical illumination is rendered inoperable due to a loss of the main power supply, such as a power outage or a fire, emergency lighting is a type of lighting that is used. A sudden loss of power renders structures dangerous for residents and may even cause panic. Emergency lighting is used to provide light in case of a power outage or other disruption to the main power source.

11. Automated Fire Doors

When the temperature inside the space exceeds a certain point, or when there has been a considerable increase in the rate of temperature rise, smoke, or other combustion products inside the space, a fire door automatically closes the space.

A magnetic system often holds open automatic fire doors. The door will automatically close after receiving a signal from a fire alarm system or smoke detection equipment in the event of a fire. It's crucial that there be never any obstructions in the way of the door so that it can close and lock as needed.

D. General Strategy for Fire Safety

Preventing fires from starting is the first and most important approach to combat fire threats (Long Ding, 2020). Since fires cannot always be prevented, their effects should be controlled either by controlling the fire itself or by controlling those who may be exposed and their property. The standard method for handling people is to move people through a secure fire escape route in order to remove exposed individuals from the building. These conditions must all be satisfied simultaneously for people to be able to leave the building safely: a fire is detected in the incipient or growth stage (the earlier the better), occupants are alerted via fire alarm, and a safe fire escape route is present inside the building. High-rise buildings, on the other hand, make it impossible to evacuate people in a timely manner by a safe fire escape passage. In order to implement the defend-in-place method, safe havens are created on specific building levels, which the fire brigade subsequently evacuates (Greg Penney, 2020). As a result, firefighters may concentrate their evacuation efforts solely in these particular refuge areas, saving valuable time—which in a fire crisis might be the difference between life and death.

Controlling the fuel available for combustion and utilising suppression by using various fire prevention elements installed in a building are the general strategies for managing fire and its effects (Kincaid, 2022). In order to prevent fires from spreading out of control in the event of an ignite, many building regulations and standards establish an acceptable limit of the available fuel load in a building (expressed as energy floor density in MJ/m2). The building is designed to survive this specific degree of fire severity while taking into account the fire severity corresponding to this restricted fuel load. As a result, the maximum amount of flammable fuel that can be stored inside a building is based on its fire resistance requirements, and vice versa.

Utilizing manual or automated fire protection measures is the other efficient way to control a fire (Qiang Liu, 2020). In the case of automatic fire suppression systems, simultaneous operation of fire detection and suppression equipment is crucial. Condensed aerosol fire suppression systems, gaseous fire suppression systems, and automatic sprinklers are some examples of automatic fire suppression measures. Manual fire suppression, on the other hand, refers to standpipe systems or manual fire extinguisher systems. Early detection, functional dependability, and performance dependability of fire prevention devices are all necessary for effective fire suppression.

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The final line of defence is compartmentation and structural stability, which helps manage fire and its effects (Rehman, 2019). The structural stability is crucial since it aids in the localization of fire, enables safe continuation of firefighting activities, and guards against property losses brought on by complete structural collapse. It's crucial to keep the fire contained in a small area inside the building in order to maintain structural stability. This can be accomplished by adopting fire compartmentation, which restricts the spread of the fire to a small region and prevents it from spreading farther inside the building. Utilizing fire venting, which increases ventilation to the fire-affected area exclusively and exhausts the available fuel, is another option for limiting the spread of a fire (Keisuke Himoto, 2021).

III. METHODOLOGY

Descriptive research is employed in this study using a well–structured questionnaire and on-site observation as sources of data. The study population are university community members, the staff and students of the university with a sample size of 50 respondents. Questionnaires used were well structured using the Linkert scale to rate the efficiency of the fire strategies after they have been identified. On–site observation was also employed to confirm data gathered from respondents.

IV. DATA ANALYSIS

Table 1 below shows a list of active fire prevention strategies from study and frequency of the identified strategies in the study area. Fire alarm with a frequency of 4 which constitute 8%, and portable fire extinguisher with a frequency of 46 which constitute 42% were identified in the study area.

Table 1: Identification of active fire prevention strategy present at the University Senate Building

Active Fire Prevention Strategies	Frequency	Percentage
Fire alarm	4	8%
Water Sprinkler System	-	-
Hose Reels	-	-
Heat Detectors	-	-
Smoke Detectors	-	-
Fire Blankets	-	-
Portable Fire Extinguisher	46	92%
Exit Signage	-	-
Emergency Lighting	-	-
Automated Fire Doors	-	-

Source: Researcher's Fieldwork, 2022

Plate 2: Portable fire extinguisher. Source (Researcher's Fieldwork, 2022)

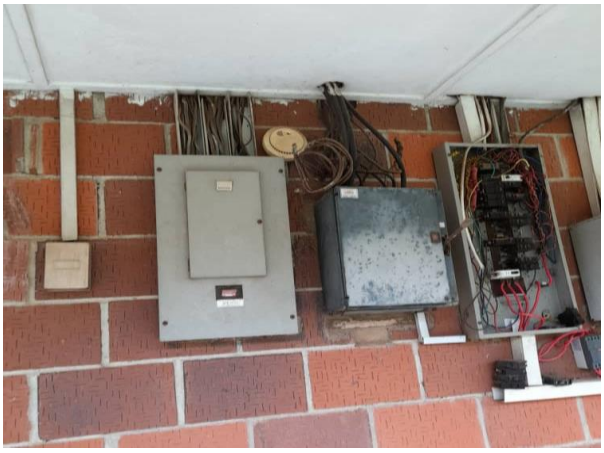

Plate 3: Fire alarm located at the electric distribution board. Source (researcher's fieldwork, 2022)

Table 2 below reports the efficiency of the identified active fire prevention strategies in the study area based on location. Fire alarm was rated slightly efficient likewise portable fire extinguisher was rated neutral which implies that location of these prevention strategies should be reviewed to yield optimum efficiency.

Table 2: Efficiency of the identified active fire prevention strategies present at the University Senate Building based on location. 1 - not efficient, 2 - slightly efficient, 3 - neutral, 4 - efficient, 5 - very efficient.

Active Fire Prevention Strategies	1	2	3		4	5
Fire alarm		●				
Portable Fire Extinguisher			●			

Source: Researcher's Fieldwork, 2022

Table 3 below reports the efficiency of the identified active fire prevention strategies in the study area based on maintenance/expiry dates. Fire alarm was rated slightly efficient. From on – site observation, it was observed that some of the fire alarms are not properly maintained while portable fire extinguisher was rated efficient based on expiry dates. The fire extinguishers are renewed regularly.

Table 3: Efficiency of the identified active fire prevention strategies present at the University Senate Building based on maintenance/expiry dates. 1 - not efficient, 2 - slightly efficient, 3 - neutral, 4 - efficient, 5 - very efficient

Active Fire Prevention Strategies	1	2	3	4	5
Fire alarm		●			
Portable Fire Extinguisher				●	

Source: Researcher's Fieldwork, 2022

Table 4 below reports the efficiency of the identified active fire prevention strategies in the study area based technological know-how. Fire alarm is a programmed active fire prevention strategy which does not require technological know – how. Portable Fire Extinguisher was rated neutral. A good number of staff and students of the university cannot operate fire extinguishers, thus placing importance on educating the community before efficiency can be attained.

Table 4: Efficiency of the identified active fire prevention strategies present at the University Senate Building based on technological know-how. 1 - not efficient, 2 - slightly efficient, 3 - neutral, 4 - efficient, 5 - very efficient.

Active Fire Prevention Strategies	1	2	3	4	5
Fire alarm					
Portable Fire Extinguisher			●		

Source: Researcher's Fieldwork, 2022

V. CONCLUSION

The increasing rate of fire incidences across the nation is alarming and caused an awakening to evaluate fire prevention strategies. This study has carefully examined the active fire prevention strategies in Bells University Senate Building. Results shows that the building is not well equipped against fire. Senate building is a principal building in the university community and deserves a great security attention. The institution management is therefore implored to see to equipping the building with fire alarms, sprinkler systems, hose reels, exit signage, heat detectors, and emergency lightings, and then educate the university community on technological know-how and strategically locate the equipment to aid efficiency. Likewise, routine maintenance of those equipment should be encouraged.

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