

# Evaluation of Passive Fire Safety Methods in Hostel Building: A Case Study of Bells University Male Silver Hostel

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Received: 01 Aug 2022,

Received in revised form: 25 Aug 2022,

Accepted: 01 Sep 2022,

Available online: 11 Sep 2022

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**Keywords—** Fire protection, Hostel building, Passive fire, Fire safety, Property

**Abstract—** When a fire breaks out, there is very little opportunity to flee. In minutes, a fire can grow and sometimes double in size. A fire can blaze out of control in less than 30 seconds, filling the region with heat and poisonous, thick black smoke, resulting in the loss of lives and property. This makes fire safety an important factors in build services. Fire safety methods play an aspect role in improving the structural stability of buildings during a fire. Student hostels require a fire protection system capable of protecting all residents from fire hazards. This study evaluates passive fire safety methods in hostel buildings. The study would provide first-hand information on the building and evaluate passive fire safety measures put in place. The study utilises qualitative analysis (observation method). Findings revealed that passive methods of fire safety implemented in the hostel building were not adequate to meet the standard building regulations. Thus, in the course of fire only active measures that are fully installed will aid the stoppage of fire. This study recommends that adequate passive fire protection measures should be implemented at the design stage to reduce the lost of lives and properties in the course of fire.

## I. INTRODUCTION

The frequent fire outbreaks in several buildings around the world, the issue of building fire safety has recently gained a lot of attention. Buildings can sustain substantial damage, their contents can be destroyed, and in extreme situations, the occupants can be killed. (Obasa, Mbamali, & Okolie, 2020). As a result, such a huge risk to humanity needs the immediate attention of all relevant parties in order to minimize this risk. The use and control of fire advanced man, bringing many benefits to man in a variety of ways; however, the multiple benefits of fire are sometimes overshadowed by its massive devastation capacity. As a result, despite current fire prevention

methods, it is widely assumed today that fire danger cannot be eliminated.

Fire is a possible life hazard in every structure, and it has the ability to cause a worst-case situation if sufficient fire control system is not in place to prevent fires. Building fire safety procedures are part of fire protection system, which aims in the reduction of fire risk to an acceptable degree through fire disaster prevention and mitigation. It is concerned with the adoption of both passive and active steps to limit the risk to life, damaging property, and ecological effects. A good protection system design is required so that the building is "alert" in the event of a fire and fire losses are minimized, particularly in public facilities and buildings that house a large number of

people. The consistent rise in fire-related incidents in student hostels emphasizes the importance of hostel administration and students following measures that ensure total protection of lives and property. The passive fire protection systems in the hostel structure are being investigated at Bells University of Technology Male Silver Hostel in Ota. The hostel has one hundred and eight (108) rooms, sixteen (16) utility spaces, six (6) common rooms, six (6) public bathrooms, one (1) hostel cafeteria, (one) 1 hostel office, and (one) 1 porter's lounge. The hostel has a capacity of six hundred and five (605), including students and porters. Electrical fires can occur in a hostel building due to faulty electrical outlets, the use of ungrounded plugs, the misuse of extension cables, the overloading of light fixtures, and the use of outdated wiring.

## II. LITERATURE REVIEW

A fire is a state, process, or occurrence of burning in which fuel or another component is lit and mixed with oxygen, producing light, heat, and flame. (Dictionary.com, LLC, 2022). This is due to the relatively weak chemical bonds in the oxygen molecule, and the new bonds formed are more stable, resulting in net energy production. A chain effect involving dioxygen in the environment and fuel often causes fire (wood or gasoline, for example). Wood and gasoline, of course, do not impulsively catch fire just because they exist in the presence of oxygen. To initiate the combustion reaction, the fuel must be heated to its combustion point. Because the design and use of a hostel accommodate a large number of people, efforts should be made to prevent the occurrence in such a facility. A student hostel is a structure used by educational institutions to house their enrolled students (Ayuba, Abdul, & Abdulrahman, 2018).

The research on fire disaster reasons leads us to the substantial result that dramatic rise in fire accidents in universities and other types of learning may be attributed to a variety of variables. Arson is an aspect, which is defined as an intentionally fire set by a person or a crowd on either confidential or general properties, often in opposition or retaliation against organizations or authority.. Some fires are started maliciously by people who want to express their displeasure or cause destruction. Secondary school fires in Kenya were started by arsonists as a form of protest against the school administration (Alade & Abdullahi, 2022). Defective electrical connections, the employment of incompetent electrical engineers or workers during implementation, the use of inferior electrical components to save money, overloading of electronic devices, and improper electrical

wire servicing are the top causes of electrical fires. Other causes include the reckless usage of gasoline and naked flames such as candles, as well as filling a petromax while the lamp is already lit. (Alade & Abdullahi, 2022). On a Thursday evening, for example, a fire broke out in the ladies' dorm of Offa Primary School in Kwara State's Offa Local Government Area, burning six rooms and other belongings. (Oyekola, 2020). These are just a few of the reasons why fire safety measures are so important in hostels.

Fire safety refers to the arrangement and plotting of infrastructure focus at decreasing the threat of fire or limiting the fire from spreading when it does occur. Fire safety includes the use of noncombustible building material, secure workplace application, fire protection training, fire protective gear, and other activities. The following are examples of fire safety measures:

- Guaranteeing that building codes are followed (International, national or local).
  - Guaranteeing adherence with fire code requirements (exists, stairs, distinguishing features and road signs, etc.) complying with electrical safety laws .
  - Fire risk evaluations whenever a construction, equipment, or operation is changed.
  - Improved stowage of highly combustible and toxic substances.
  - Construction of fire detection and automated or semi-automated fire alarm systems.
  - Sorting of appropriate forms of operational firefighting equipment and hydrants (Pontip, Ahmed, Erekpitan, & Detur, 2020)

Two types of fire prevention tactics are employed to achieve the goals: active and passive fire protection measures.

An active fire protection system is an inactive technique that must be initiated in the event of a fire in order to operate properly (steam rings around flanges, activation of water spray systems, sprinkler systems, deluge systems, fire water monitors, ). Passive Fire Protection measures are incorporated into the construction to offer solidity into the walls and floors, separating the building into sections with dangers or compartments. Such security is either gotten from by the materials used to construct the structure or is added to the building to enhance its fire resistance. The researchers are evaluating the passive fire prevention methods implemented at Bells University of Technology's Silver Hostel.

Plan of environment is a major passive prevention method. A plan of the premises (preferably in A4 page

format) should be exhibit at or near the approach point , noting the area of: stairways and escape paths, fire prevention infrastructure such as sources of water, first aid firefighting equipment, gasoline and electricity supply shut-off points, containers of gas tanks as well as other dangerous chemicals, the control panel for the automated detection and alarm system, and any ventilation system manage devices. During an occurrence of fire in a building, it produces a huge amount of smoke and fumes. Within a building, smoke and hot gases can travel vast distances and constitute a direct threat to human life. Escape routes must be provided to allow the occupants to reach safety. They must be sufficient and cable of being utilized safely and fuctioning at all times. Tall building escape routes should be adequately structured to allow residents to pause briefly while evacuating, to reduce the threat of smoke within stairs, and to serve as a staging place for firefighting actions. When analyzing the means of escape, it is vital to analyze the evacuation process. As indicated below, the evacuation procedure can be separated into numerous stages:

Phase 1: Evacuate the area or room to a common corridor, a safe stairwell, or a final exit.

Phase 2: evacuate through a common hallway to a protected stairway or a final exit; and

Phase 3: evacuate vertically by a protected staircase to a final exit and a predetermined assembly site.

Moving laterally away from the danger of the fire is part of Phases 1 and 2, while moving vertically from the top levels is part of Phase 3. Vertical transportation is frequently accomplished by secure stairways to a safe point outside the facility. An outdoor escape stairs may be used to evacuate the building(Elhefnawi, 2020). Except in the event of a tiny institution, which may be served by a single evacuation stairway under certain conditions, each storey of the structure should have at least escape routes. This measure is predicated on the likelihood that one of the emergency exits may be rendered inoperable in the event of a fire. Diverse and unconnected fire exits from a storey should exist. Aside from having at least two escape routes from each storey, escape pathways should be wide enough to allow for the removal of the population occupancy of the rooms or areas they serve, with a minimum width of 6 ft (1830 mm). In order to function as a means of escape, moving span one through an escape path from any position in a structure should be limited to the degree determined by the availability of different escape paths. A distinction is made for this purpose between: - travel from any site where escape is only possible in one way (commonly referred to as dead-end travel); and - travel from any location where escape is

feasible in numerous ways, using a different escape paths. Vertical fire exits are parts of the escape routes that connect the upper stories of the building to a safe refuge in the open air on the first floor. Vertical fire exits should be through fire-resistant stairwells in the structure. The enclosure to the stairwell at all storeys is protected, as is the provision of protected lobbies between the stair enclosure and the lodging, if necessary. An exterior evacuation stairway may be the only viable option for offering an alternative method of escape from a structure in some instances. Vertical escape routes must be protected from smoke and fire by enclosing them in fire-resistant architecture. Stairway protection also helps to keep fires from spreading between stories. To reduce smoke entry, doorways leading into a protected stairwell must have self-closing fire doors, according to fire resistant construction requirements. A protected hallway between the stair enclosure and the housing may be necessary in rare cases, such as when a structure is served by one stairway. Doors from rooms is adviced to not, in general, open directly into exit stairwells. Only shielded corridors or lobbies should be used to connect rooms to the escape stairways. A toilet or bathroom, on the other hand, that is not used to store flammable components but may include a water heater and is disconnected from the rest of the building by fire-resistant architecture, may detach directly to the stair surroundings. Circulation paths in a storey should be kept as far away from escape stairways as possible. Emergency exit stairways should lead directly to a safe location on the ground in the open air. Fire doors, an important part of fire safety, are provided to limit the growth of fire and smoke within a structure. They are utilized in compartment wall openings and the enclosures of protected stairways and lifts. They are also common through and across a safe escape path. Fire doors with minimal standard fire periods of 30 and 60 minutes, accordingly, are designated by the door types FD30S and FD60S, and are fitted with cold smoke seals. (Building Control Alliance , 2013). The minimum room height is 300cm, and it must have a fire-resistant door that can withstand a 2 hour fire. A "safety zone," also known as a Fire Assembly Point, is an essential component of any emergency response plan. In order to give an easy location in the event of an emergency, it should be well-known and well marked. The Muster Point should be located far enough away from the structure to give heat and smoke protection in the case of a fire, but not so distant that it discourages from using it (Best Practice Guidance, 2018). Employees, guests, and building users should not be endangered by emergency vehicles responding to the event or by general/other traffic in the area, hence Fire Assembly Points should be directed away

from car access routes leading to the building. Fire Assembly Points should ideally be positioned so that they do not need crossing a road or going through busy areas..

### III. METHODOLOGY

The hostel appears to be located at the intersection of the silver female hostel and the male bronze hostel. The male silver hostel is a 3-floor facility with 108 rooms and a

variety of workspaces including the Bells consult, portal office, media room, and so on. This is an important survey that looks at data on passive fire measures used by built environment professionals to put out the fire in the men's silver hostel. The audit variables and signs show explicit data obtained from Google Maps indicating the existing developing region surrounding the hostel facility, as well as fundamental data obtained from field findings.

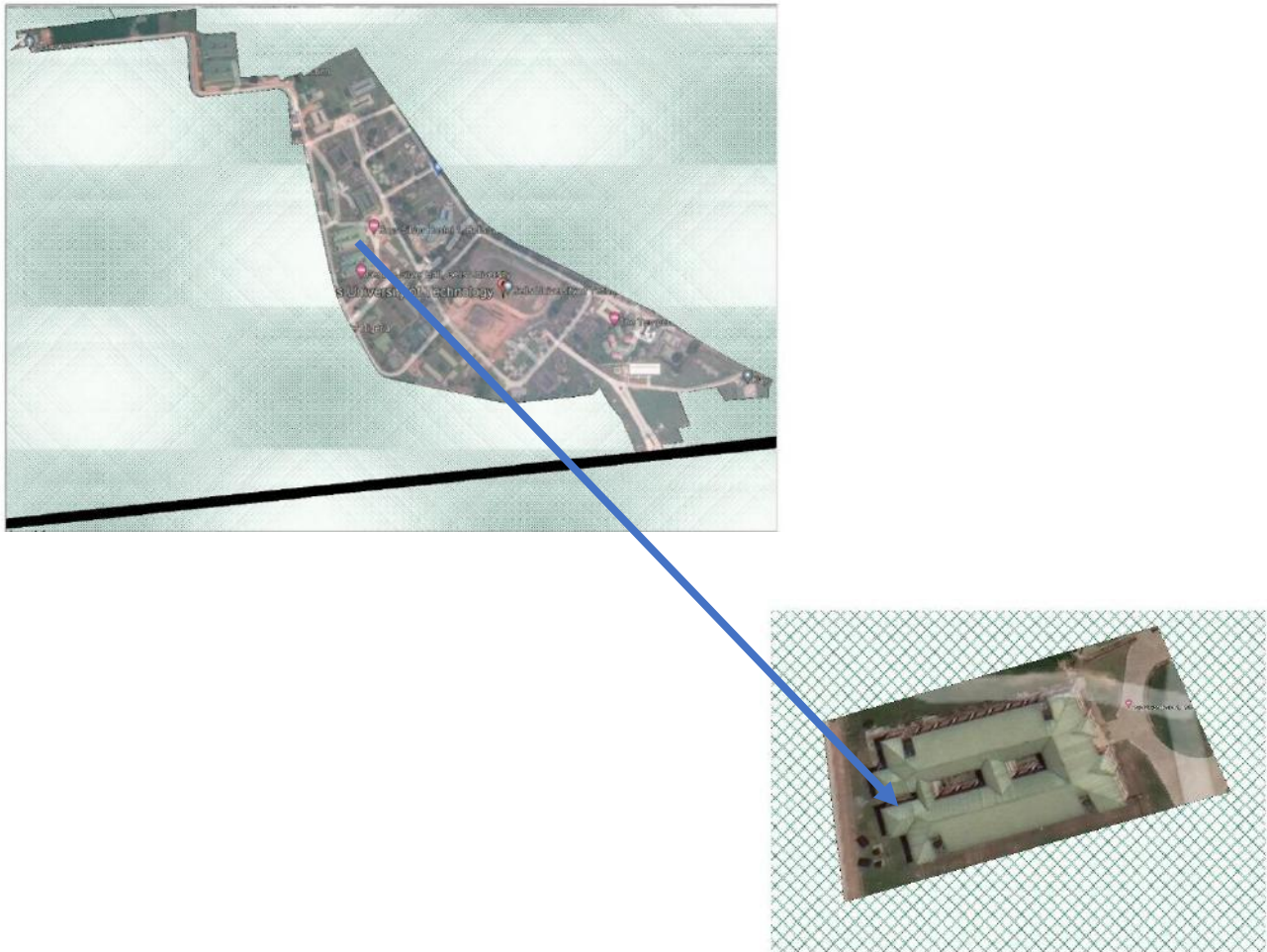


Fig.1: Layout of Bells University of Technology Ota showing the male Silver Hostel in Bells University

Source: Googlemap, 2022

### IV. RESULTS AND DISCUSSION

**Firewall:** It is a non-combustible fire separator that subdivides a structure or divides neighbouring structures to resist fire growth and has a fire-resistance rating as specified in this code as well as strength to maintain intact under fire circumstances for the required fire-rated period. Geopolymer bricks can be manufactured to be fire resistant. As a result, high-calcium fly ash geopolymer

may be employed as a fire-resistant material. (Iverson, 2017)

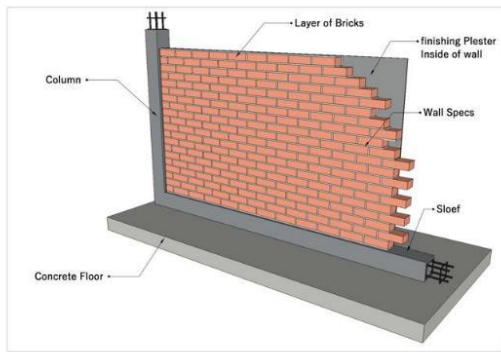


Fig.2: Traditional plastered brick wall as a means of passive fire protection

Source: Thermal Environment Control of Buildings using Installation of Plants and Metal Panels on Brick Walls,2021



Plate 1: Hostel perspective indicating the entrance through the access road

Source: Author's Fieldwork, 2022

It is suggested that Bells University administration should consider the arrangement of neighborhood-based fire apparatuses and educate individuals both staff and student on the proper manner of dealing with or utilizing bare fire and electrical apparatuses

The concentrate is thusly close by suggesting improvement of hostel fire preventive and control limits through legitimate instruction, sponsoring expenses of dynamic fire gear, and upholding consistency with the different structure security codes during the plan, development, and control of structures.



Plate 2: Image of First Floor plan of Silver ostel, Bellstech

Source: Author's Fieldwork, 2022

Fire entrances are important passive fire measures of fire protection framework and should generally be kept shut. The occupant ought to be made mindful of the fundamental job that such entries play, and of the significance of not setting or wedging them open. This message ought to be underscored by suitable "Fire Door-Keep Shut" signs shown on each fire entryway. A fire exit means by which evacuation is directly out of the hostel

facility should be utilized if there should be an occurrence of fire. Any construction with steps higher than three stories needs no less than two crisis passageways with a most extreme distance of 25 meters from all spots of individuals in a design block. The crisis exit should be flame resistant for roughly 2 hours, with programmable locking and advance notice signs situated at the highest point of the entry page. In the silver hotel, there is a

degree of criticality, and it does not relate to the essentials of the degree of the fire incidence. The crisis steps incorporate fire doors. However, the fire doorways in the design use steel materials that are not heat-resistant and not appropriate for use as fire doors.



Plate 3: Image showing the fire escape door, brick wall, and escape staircase in the building.

Source: Author's Fieldwork, 2022

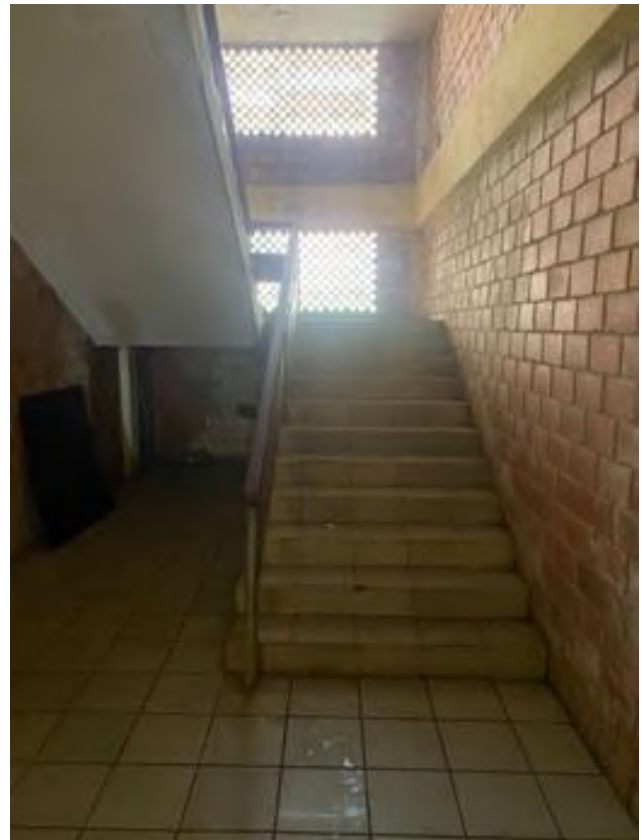


Plate 5: Image of Escape Staircase in the building

Source: Author's Fieldwork, 2022



Plate 4: Image showing the escape route

Source: Author's Fieldwork, 2022

In the event of an emergency, tenants should be able to leave the silver hostel premises quickly and safely to a muster point via pathways that are safe from fire, smoke, and deterrents.. This must be accomplished through the fire escape route and staircase departure courses are unhampered. The fire doors should be kept shut as required and not be used as a normal through fare.

Table 1: Fire Resistance Rating

Location	Fire resistance rating hours
Enclosures for exit access corridors	1
Fire partition wall and fire wall	1. 2
Fire brick wall	1. 4
Fire door	1.5
Aluminum roof	2- 4

Source: Author's Fieldwork, 2022

An "electrical fire" is another hazard that can cause a fire. It is not simply a fire that started in an electrically powered device. If this were the case, an electric hob fire caused by overheating or improper wiring would be

classified as an electrical fire, which it is not. An electrical fire, on the other hand, is a fire that is directly caused by the flow of electric current or by static electricity.

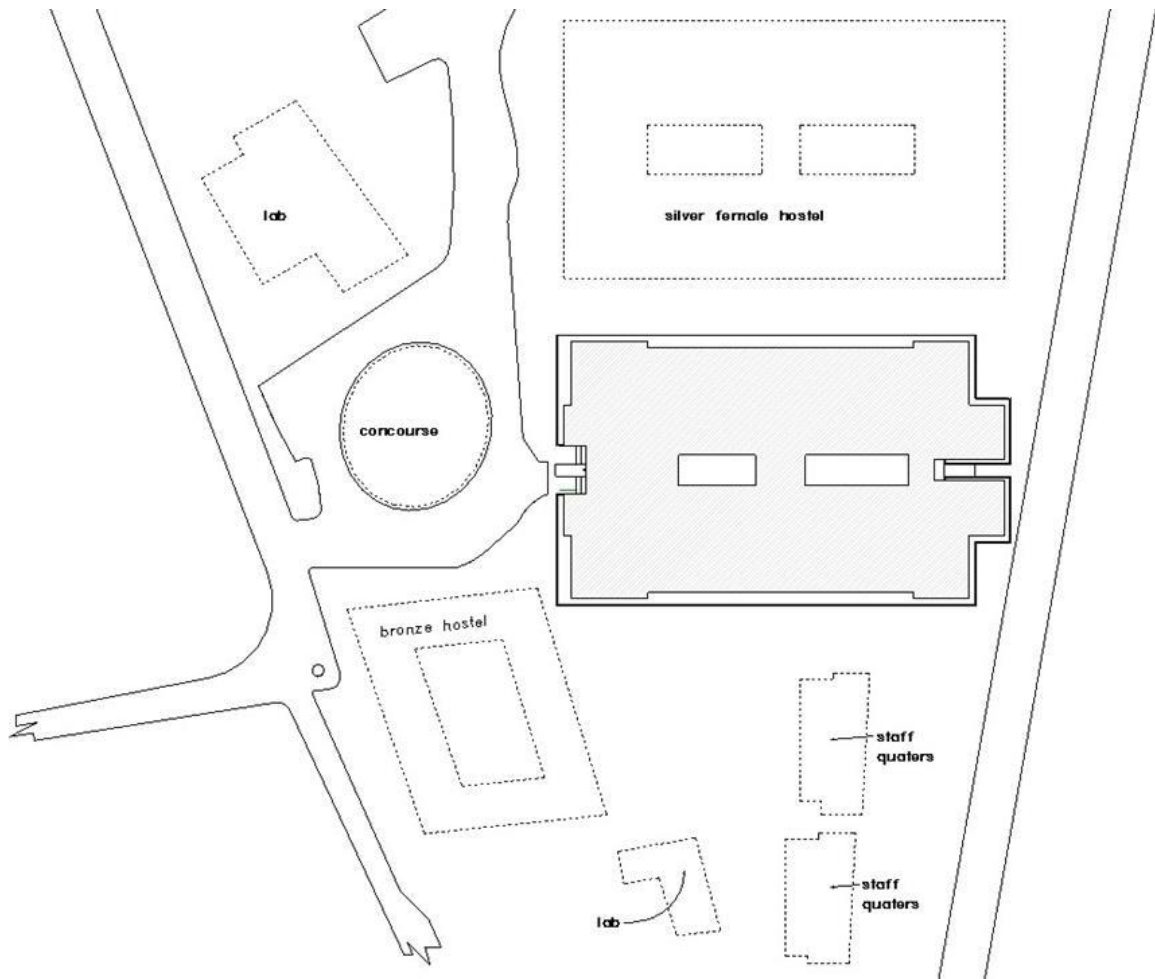


*Plate 6: Image Showing Existing Exposed Electrical Control Box Imposing Risk to the Occupant of Silver Hostel Facility, Bellstech*

Source: Author's Fieldwork, 2022

The silver hostel is 65 meters long but has entrances and exits at both ends. This is contrary to the recommended maximum crisis. A crisis leaves a stepping stool, which is a safe move toward sitting tight in the event of a fire. According to Minister of Public Works Regulation No.

45/PRT/M/2018, each state should have at least two crisis estimates that work with a few stories and a maximum distance of 30 m). At or near the entry, a layout of the premises (ideally an A4 page design) should be displayed.



*Plate 7: Image Indicating the Existing Facilities' Ambient Environment*

Source: Author's Fieldwork, 2022

The floor plan indicates the fire escape route of flights of stairs and getaway courses, The asphalt road behind the hostel and the water ladder should have a minimum width of 6 meters, a foot of 15 meters, and a foot of 4 meters at the dividing crossbar for the transfer of bombs. The distance between silver hostel and adjoining buildings is less than the recommended minimum distance of six

metres. Roof radiation dampers safeguard pipe infiltrations, which enter the roof film of an imperviousness to fire evaluation. It is just through the appropriate development and security of openings or entrances that an imperviousness to fire evaluated gathering can do what it is expected to do.



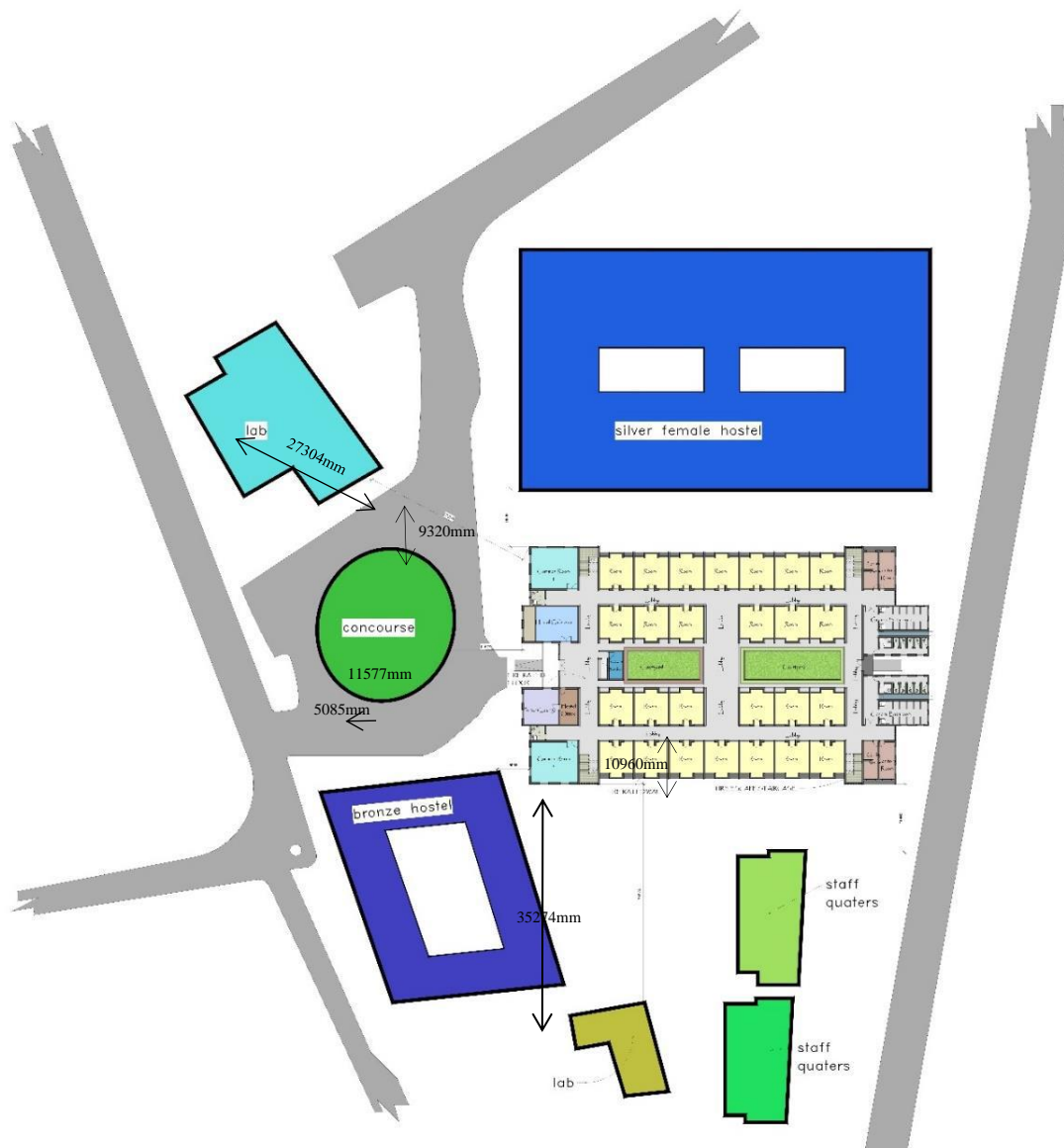


Plate 8: Showing the Distance Between Silver Hostel to the Surrounding Building

Source: Author’s Fieldwork, 2022

The distance between the bar and the surrounding structures satisfies fire safety principles. The structures are separated by 9.3 meters in the north, 6.0 meters in the east, 10.9 meters in the south, and 11 meters in the west. Site design is a direct game plan for preventing and mitigating fire hazards, and it includes design planning and execution, design division, nursery hydrant placement, open space placement, and other elements. The blacktop on Main Street should be the primary environment through which fire engines travel. The path should be made clear at all stages of development (except classes 1, 2, and 3).

to the firing motor. The black-top layer should constantly be liberated from metal boundaries, blocks, or layers that aid in the stacking of gear.

## V. CONCLUSION

The male silver hostel is the sole structure where the buildings are fewer than 6 meters apart, while the male silver hostel has various fire safety measures that do not satisfy the required standards, such as the staircases being more than 15 meters away, which is less than the 6 m interbuilding distance. There are two emergency staircases in the hostel and one emergency door made of non-fire rated material on the hotel building. The suggestions include expanding the middle of the structure with stairs to accommodate more pupils and changing the emergency door to one made of fire-resistant material.

## VI. RECOMMENDATION

This study recommends that fire-rated doors should be allocated at both ends of the existing fire escape stairwells. This has been identified in plate 7 has AA and BB. Furthermore, the fire escape door used in the building is not up to standard, fire-rated doors is what should be implemented. Creating a comprehensive fire safety system starts with the basic passive protection elements required by law. Fire-rated doors in hotels are imperative to keeping students safe and allowing them to safely evacuate the building in the case of an emergency. Fire doors play an important part in the passive safety of hotel employees and guests. Standard fire ratings range from 20 to 180 minutes, depending on code criteria. Fire-rated doors must be self-closing and firmly latching. To preserve the means of egress, they must remain closed during a fire.. We also noticed that the stair wells are not fire rated. We noticed that there was no allocation of a muster point in the building design. Even in the midst of an emergency, the muster point guarantees that everyone knows where to congregate. The location should be safe and free of additional dangers from the work site. Muster stations also make it easier to conduct head counts and other measures that need everyone to congregate in one location. Muster stations enable supervisors or other designated individuals to conduct a roll call in order to locate any missing employees who may still be present.

Furthermore, the administration of Bells University should examine the placement of neighborhood-based fire apparatuses and educate individuals on the correct mentality for dealing with or using bare fire and electrical apparatuses on the job site following the evacuation.

## REFERENCES

- [1] Alade, E. I., & Abdullahi, A. G. (2022). Application of Cause-and-Effect-Analysis for Evaluating Causes of Fire Disasters in Public and Private Secondary Schools in Ilorin Metropolis, Nigeria. *Archives of Current Research International*, 11.
- [2] Alao, M. K., Yahya, B. M., Wan Yousuf, B. W., Aliu, Ibadayo, & Ukpoireghe. (2020). Fire Safety Protection and Prevention Measures in Nigeria office buildings . *International Journal of Management and Humanities (IJMH)*, 7.
- [3] Ayuba, P., Abdul, C., & Abdulrahman, M.-H. (2018). Post-Occupancy Evaluation of Students Hostel Facilities in Federal Universities in North Central, Nigeria. *Scientific and Academic Publishing*, 5.
- [4] Best Practice Guidance. (2018). *Choosing a Fire Assembly Point*. Produced in Partnership with Lincolnshire Fire & Rescue .
- [5] Building Control Alliance . (2013). FIRE DOORS IN DWELLINGS. *BCA Technical Guidance Note 9*, 3.
- [6] Dictionary.com, LLC. (2022). *Dictionary.com*. Retrieved from <https://www.dictionary.com/browse/fire>
- [7] Elhefnawi, M. (2020). *ESCAPE ROUTE DESIGNS AND SPECIFICATIONS FOR OFFICEBUILDINGS – “CCIAT” BUILDING AS A CASE STUDY*. BAU JOURNAL - CREATIVE SUSTAINABLE DEVELOPMENT.
- [8] Ivison, J. T. (2017, January 5). *Fire Protection Engineer and code consultants*. Retrieved from Design and Construction of Firewalls: <http://www.johnivison.com/design-and-construction-of-firewalls/>
- [9] Kuligowski, E. D., Peacock, R. D., Reneke, P. A., Emily, W., Hagwood, C. R., Overholt, K. J., & Elkin, R. P. (2015). *Movement on Stairs During Building*. NIST Technical Note 1839 .
- [10] Obasa, O., Mbamali, I., & Okolie, K. (2020). *Critical Investigation of Causes and Effects of Fire Disaster on Building in Imo State*. IOSR Journal of Environmental Science, Toxicology and Food Technology ).
- [11] Oyekola, T. (2020). *Fire guts school hostel in Kwara, destroys apartments*. Retrieved from Punch: <https://punchng.com/fire-guts-school-hostel-in-kwara-destroys-apartments/>
- [12] Pontip, S., Ahmed, U., Erekpitan, O.-A., & Detur, G. (2020). An evaluation of fire safety measures in high-rise buildings in Nigeria. *Sustainable Cities and Society*, 3.