# Approaching Modified Design and Operation of Fire Safe Facilities at Ahsanullah University of Science & Technology

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**Abstract**

In universities, fire accidents pose a severe threat to the lives and properties of teachers and students, because fire evacuation is difficult due to the dense population, numerous experimental instruments, and various flammables and explosives on campus. This paper explores deep into the fire safety of university buildings, and analyses the types and hazard sources of fire on campus. The objective of this research report is to discuss the primary issues concerning university buildings and to provide a modified layout for the fire safety design of university buildings that comprehensively integrates all aspects of fire safety. The paper classifies the factors that make university facilities a high-risk type of buildings to fire; reviews causes of fires in universities and identifies potential high-risk areas to fires in university facilities; provides modified layout and reviews design and operation factors controlling fire severity. Due to the absence of fire facilities in the present architecture, this article proposes a significantly improved fire plan that increases fire safety in all dimensions. Finally, the research is summarized, and the corresponding opinions and suggestions are given for the university fire safety management.

**Keywords:** *Fire, Fire safety, Layout, University fire facilities*

## 1. INTRODUCTION

University building fires provide a wide range of difficulties for fire fighters. A large number of occupants, demographic diversity, numerous ignition sources, high fuel loads, and insincere students and other staff members create a number of issues that can be difficult to resolve. Building rules and fire safety design must be brought into alignment with these concerns.

Universities are a unique sort of structure that houses a large number of people in a constrained environment for the purpose of education. In the event of an emergency or crisis, the majority of university occupants are students, who can be difficult to manage. When a university goes up in flames, the resulting damage is significant. Loss of life, loss of property, and loss of university operations are all included in the damages. The non-financial damages outweigh the financial damages. In the aftermath of a fire at a university, the interruption of operations will have an adverse effect on students, their families, and professors' mental health. To guarantee the safety of university residents, the supply and continuous maintenance of fire safety systems is a critical priority for the institution.

It is necessary to achieve three main objectives in terms of fire safety in the workplace. Maintaining proper separation between heat and heat sources is an important component of "prevent igniting of building materials" and "prevent ignition of contents." Controlling the spread and development of fire is the second objective of "control fire development," which includes detecting fires using heat, smoke, and flame detectors; controlling combustion; and limiting the rate of fire spread. As part of the

third aim, "defend the exposed," inhabitants of the building are informed, evacuation routes are provided, and those who remain are protected. Designers and university administrators must guarantee that adequate safety measures are supplied and appropriately maintained. Fire safety strategies must be developed with this information in mind. If a fire does break out, the university needs to be designed and operated in a way that minimizes the loss of students and faculty.

Assessment of fire safety considerations during the design phase of Ahsanullah University of Science & Technology is the goal of this paper, as well as to present a modified layout for existing university facilities to identify and eliminate fire hazards, and to meet minimum requirements under current laws. For this research, the author decided to explore the elements that make university facilities a high-risk kind of building to fire, the causes of fires in universities, and identify probable high-risk locations to fires in university facilities. It also examines the impact of fire severity-controlling design and operating aspects. Staff and management of university facilities can benefit from this paper's practical advice for their day-to-day tasks.

Analysing flammable systems and flare stacks, allow us to deduce that the potential of the explosive environment to develop in an inflammable emergency is their fire hazard. In the calculation, it is determined that the radius of the estimated excess explosion pressure from the ignition of gas mixtures may vary up to 100% depending on the design characteristics of flaring systems. Furthermore, increasing the flare stack height lowers the negative effect area by 400 percent. (Kostiantyn et al., 2021)

Photovoltaic modules (PV) are generally regarded as safe and dependable. However, in the event of widespread grid-connected PV systems, the problem of fire safety of PV modules becomes more significant because of the high voltages of 600 to 1000V. There was a detailed debate on the two major reasons, the open fire circuit and the bypass diodes and ground failures which generate PV fire, with many real-life instances. This paper suggests preventing fire devastation, such as a PV panel mounting technique designed to minimize the chimney effect and the use of suitable bypass and block diodes. (Neelkanth et al., 2012)

A probabilistic QRA method is established to evaluate the occupant's safety risk in the development of a fire protection system. This approach shows that a large amount of work has been put into the design of fire safety by connecting the conservative input variables to the FSE output safety factor. The risk level also takes into consideration the efficiency of safety measures. Applying the extended technique to a documentation of a retail centre shows the chance to analyse structure design, security systems, and time frame. (Xavier D et al.,2019)

A mathematical technique is created that employs the gray risk method, the analytical hierarchy and bold assessment strategy. A thorough evaluation technique is established based on the Gray-FAHP mathematical method. This method provides high-level building fire safety and the extent to which each test is a member at the same time. The mathematical model may also be utilized in other fields. The technology and implementation of fire risk assessments in high-rise structures provides a basis for research into fire safety engineering. It may recommend the "power-oriented" design of high-rise structures and enhance scientific, rational and efficient fire stoppage and management of all types of high-rise buildings. In addition, a particular application value may be provided and promoted and extensively utilized. (Li, Tao, Zhang,2018)

The current knowledge of the impact of fire damage is affected by data constraints, incomprehension, and inability to properly assess the behavior of the renter. Research seldom takes into consideration, such as; occupant perception of the danger of fire (e.g., flames/smoke when first seen); the resulting commitment (enter smoky room, confront flames); the accuracy of perception of hazardous size when

the researchers are recollected. Two investigations (N=141, 132) revealed short kitchen fire videos, both small, medium and big. The performance of participants in risk-recollection and their readiness to (hypothetical) agreement with the risks was evaluated immediately after (Experiment 1), or after delay (Experiment 2). (Lynn et al.,2020)

The fire hazardous time of arrival and the evacuation scenario is studied. If the fire extinguishing system fails to function using Pyrosim and Pathfinder program; then simulate smoke spread and human evacuation in the fire in Nanjing University Library. This model of STEERING has been more suited to the evacuation of the library by humans; the necessary safe evacuation time to the reading room and library has been 165s and 411s, respectively. The conclusion is that the exit of each layer is the first to reach the risky condition; the dangerous area's direction is also the safe evacuation route. As a result, individuals were susceptible to fire smoke threats. The findings indicate that the library and the reading room are at risk when the smoke is down to 2m. The staff height, smoke volume, alarm and other variables should thus be considered when designing a smoke control system. Appropriate facilities are recommended to prevent smoke from intruding into space layers and to safeguard the safety of staff. (Ming, Zheng et al.,2018)

A study on how to select a university dormitory fire safety assessment index using scientific analysis is established. In order to reduce effectively the rate of fire accidents in universities, we must begin with insecure human behaviour, unsafe conditions of things, management defects and the surroundings of university buildings, lower the threshold for the relevant elements, ensure the safety of the standards of human comportment, enhance the state of affairs, strengthen management and restructuring. In hazardous behavior, the main cause of accidents is students' usage of high-performance electrical devices. Therefore, students should be carefully monitored to use all types of high-performance electrical appliances or other means in order to allow students to utilize low-power electrical appliances. Finally, the study is summed up and the relevant views and recommendations are provided for management of fire safety in the college dormitory. (Zhang and Fan,2019)

The crucial smoke height has been established on the basis of student height in the college building. The fire-simulation shows that the smoke at steps 1 and 2, near a fire-class room, respectively, reached critical height in the second floor at 63s and 76s.The remaining entrances on the first floor and stairways were damaged, but remained accessible. Except the classroom for fire. The average second floor temperature variation was 5°C. The overall evacuation time increased by 21s after the outbreak of the fire. Exit 1 is the only evacuation exit where evacuation is fired more quickly than fired. The findings of the study provide a useful reference to fire safety in comparable college buildings. Future study will improve the output arrangement and develop an appropriate evacuation strategy. (Mingbiao et al.,2020)

Here fire and safety evacuation performance in college library safety evacuation is studied. The on-site survey evaluated the fire loads and evacuation crowds in readings. A huge quantity of books, crowds of people, 1st, 3rd and 4th reading rooms were the main areas of fire prevention and safety evacuation via field surveys. With regard to loading books, evacuation distance and quantity of evacuators, 4th reading room was the worst area for security evacuation. It was expected under the fire scenario. RSET was computed on an empirical basis and FDS simulation estimated for ASET, receiving RSET <ASET. The findings showed that the fire-protection system for the fourth reading room could satisfy the safety evacuation requirement; the study of the college library's performance-based fire-protection and safety evacuation design revealed that the fire-protection systems could fulfildemand. (Chixiang, Hui et al.,2012)

The effect of an intervention on parent-only fire prevention on the knowledge and conduct of primary university children is identified. This was a prospective, almost randomly controlled research, in

which children from two elementary universities in the urban, impoverished, minority neighbourhood completed baseline knowledge and behavior questionnaires and completed the intervention. This research gives an insight into how parental-oriented Community-based fire prevention may impact primary university students. The increase in behavioral scores amongst kids indicates that families with fire prevention interventions have altered certain fire safety behaviors in their households. The most effective method to improve both fire safety knowledge and behavior in homes with children may be a combined approach in which children get fire prevention education in university and the households receive an intervention like that given in our research. (Hwang, Durbin et al.,2006)

## 2. METHODOLOGY

### 2.1 System Design & Modelling

Fire safety in university buildings involves the defence of students and instructors in the buildings of fire, the escape of students and teachers and students and professors staying at their institution. These groups need to take various problems and fire safety procedures into account for fire protection. Fire safety at university premises is usually focused with the safety of lives of people outside the fire university. This is mostly due to problems in safeguarding the residents in the original unit unless sprinkler shelter is given. When a fire happens at the university, students and instructors are warned by a detecting apparatus or the flames. If the students and other staff don't escape the spot, they may turn deadly. Therefore, the most efficient way of safeguarding students and other staff at the fire university, if they are incapable to escape or depart, is by use of a sprinkler structure. The apparent issue to be answered is: the existing precautions on fire safety are sufficient. The answer is "no", because there is plenty of scope to improve the fire safety measures.

**Existing Layout:**

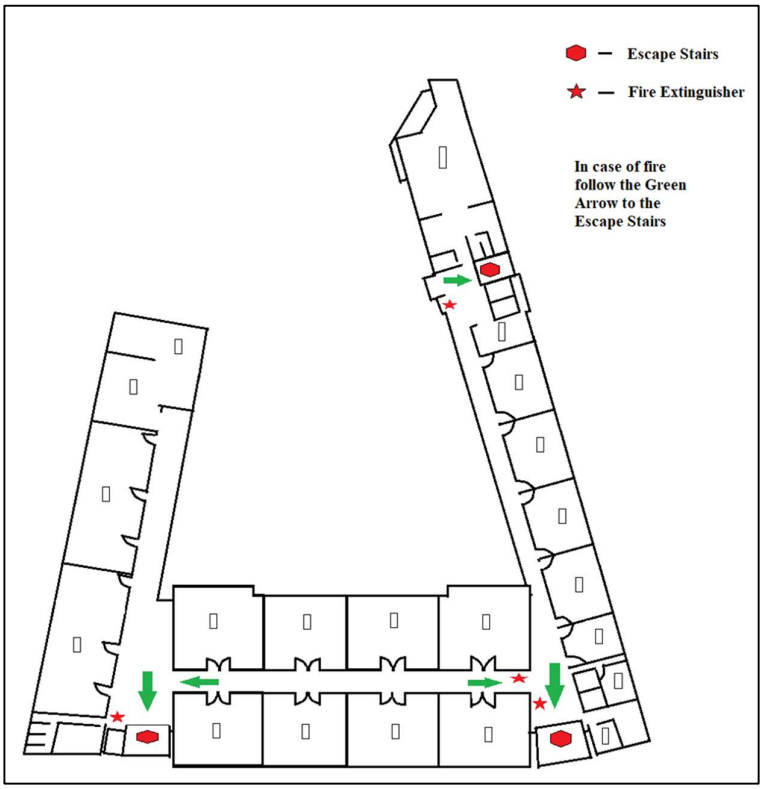



**Figure 1:** Existing Layout of departmental floors

In the existing layout, there are four fire extinguishers and three stairs that will be used as escape stairs in case of a fire. The first fire extinguisher is placed in Block C near the stairs, the second one is placed in Block B. And the rest of the extinguishers are placed near the rest of the stairs in Block A, which is not sufficient for fire safety design layout.

**Modified Layout:**

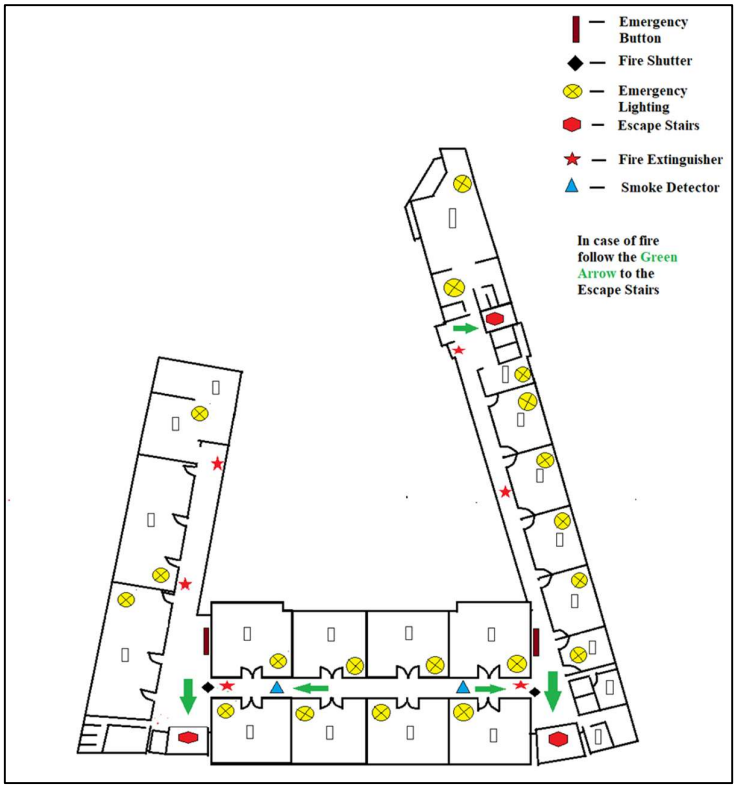



**Figure 2:** Modified Layout of departmental floors

In the modified Layout, many things have been added to the existing layout, like 2 emergency buttons, 2 fire shutters, 19 emergency lights, and 2 smoke detectors. The smoke detectors are placed in Block B, as most of the labs are situated in Block B so there's a chance for a fire incident to take place. That's why both fire shutters are placed in the gateways of Block B. There are 19 emergency lights which are placed in each room. In case of a fire incident, there are two emergency buttons placed outside Block B. The emergency lighting will start if the emergency button gets pressed. And 2 more fire extinguishers have been added to the existing layout in Block C to provide more safety.

## 2.2 RESULT & DISCUSSION

This section discusses some fire safety precautions for the design of university buildings for a fire engineer. This section focuses on fire safety measurement performance and areas which are not fully covered by regulations and standards. These kinds of security methods are provided below:

### 1. University Building and Passive Protection

All university buildings have a fire defiant evaluation for the structure of construction and fire barriers. Either via the appropriate building code or a fire engineering study, this fire resistance is calculated. Passive defence is one of the most essential components in fire expansion and fire range

prevention. When the structure is split into perpendicular and flat divisions, the carburant is divided into lesser units that decrease the possible flame volume. In order to stop and restrict the smoke from expanding through the structure, passive protection is also necessary. The primary purpose of the report for passive defence is to restrict flame and smoke to the university building of fire. This reduces the danger to other university buildings and will offer them ample time to leave or for the fire department to extinguish the flame. The university's building and systemic fire resistance rating may be calculated from a time equivalence formula. By using this technique, a university should confine a fire until it is completed. This must guarantee that the fire does not spread beyond the origin of the university.

Doors, walls, floors, ceilings, ice sheets, smoke dampers, building units have to be examined, tested and maintained frequently to provide efficient passive protection. Fire separation and division depends on these components. The installation of self-closers on doors which are open in common spaces is suggested to avoid fire and smoke spreading from universities onto public areas or runoff pathways.

**2. Fire Protection for Lifting Installations**

Since the lifts connect level, they may harm the escape routes. In order to defend opposing this, the following settings must be seen.

Elevators such as wall elevators or lifts with huge volumes, for example a center or an atrium, without a conventional good, may be endangered if passed through a smoke storage tank. The integrity of the smoke reservoir is preserved and the lifting passengers are guaranteed in this situation.

Either in boxes of secured staircase or closed with a flame-resistant building throughout its height, if they are placed in order to prevent departure.

A lift linking multiple buildings should create a protected shaft. Only a secured lobby (or secured corridor) has to access the elevator in the basements, unless it is in the shelter of a protected staircase.

If there are, a. building (or part of a structure) serviced by just one escape escalator and fire burning from the bottom level may be harmfully affected by escape routes on the top floor of the building (or part of the structure), or b. a leaving stair ends in the ground floor.

If the elevator well is in a safe step (the only step in the building), no lifting motors on the steps should be provided (to dodge smoke blowout from a flame in the lift machinery). However, if necessary, lift engine rooms may be located high above the elevator.

**3. Fire Intervention Brigade**

In most fireworks, the fire brigade's involvement is generally not contemplated. The Fire Brigade is the final line to fight a fire and generally the last chance to locate and save people. The fire brigade's involvement is largely reliant upon getting an alert or fire notice. The function of the fire unit is essential in the university fire since it can:

- Fighting, suppression, and extinguishing of the fire
- Explore and saving operations
- Outside saving students & other staffs
- Evacuation control via EWIS structure and/or elevators
- Primary assistance
- Clean-up inhabitants

To ensure the correct performance of fire brigades they need

- enough site entrée
- sufficient water supply
- Fire system direct centers and fire display boards
- lift control
- Protection against structural failure for an acceptable period of time.

Successful intervention by fire brigades may be accomplished through preparation, early warning, quick reaction and adequate labour and gear to cope with the risk (Becket al, 1992).

The period for the fire department to appear and quench the fire is affected by: (Buchanan,1996 according to)

- Fire detection time. Whether via automated systems or humans
- Fire brigade notification time
- Travel time for the fire brigade
- Access and search time for every level
- Fire brigade set-up time
- Fire assault time

The Fire Engineering Guidelines (FCRC, 1996) include a 'Communications and Response fire brigade' model that offers advice for evaluating fire brigade response. The following fire brigade timings are 95th percentile PEG times (FCRC, 1996).

In a plan against evacuation, the fire department may have depended on to control and extinguish the fire. Notification and arrival timings are thus important. An emergency plan in which they are asked to speak with pupils or help in evacuation may also be essential for the arrival of the fire brigade. If contact with students is essential to the emergency plan, well-trained guardians are responsible before the fire brigade arrives. The fire brigade's involvement must be discussed with the consent officials or officials having competence (AHJ) and fire brigade. The intervention periods must be approved by all parties.

Sensitive designs and architecture may assist the activity of the fire department. For instance, placement of hydrants, tapers and fire warning boards should be planned to help the fire brigade operations. Some of the difficulties the fire brigade faces in a fire are: fighting flame during deportation, restricting entry to a fireplace with evacuating people, and reducing efficiency due to tiredness following the escalation.

**4. Training and Education**

Training and education of students and other staff in buildings is a key element in fire safety which is frequently ignored. Many fire deaths come from poor decision-making and pupils are not aware of the impact of their actions. There have been many fire deaths or the issue has been worsened by students who are unable to shut doors, disable self-closures and remove batteries from smoke alarms. Emergency training and education and fire safety may decrease the number of these deaths. However, roof access doors are secured in nearly all instances. Another area of training which might be beneficial is fire prevention training (Canter, 1990). This may decrease the frequency of flame and indirectly improve the security of life indirectly. Students and other staff may also be taught to utilize firefighting equipment of first aid (hose reels, extinguishers). This allows them to be used efficiently

and to know when to withdraw or evacuate the facility. Students and other staffs in need of knowledge:

- Building Emergency Strategy
- The fire risks (smoke, heat, flames, CO)
- Fire safety in the university building measure (sprinklers, smoke sensors, extinguishes, custom made call points)
- The impacts of movements (shutting doors, deactivating smoke detectors, obstructing departure paths, securing doors, cracking windows, departure late)
- What are or are not existing alternatives in the case of a flame (e.g., shelter, roof access and lobbying)
- Techniques to minimize the danger in an evacuation or to defend an emergency plan;

Firefighters' choices are their own responsibility. Firefighters and fire engineers cannot determine if, when or if a person should escape, or remain in a position and search for shelter. The only individual who is able to create that choice is the smoke, heat and fire occupier. To help students and other staff to make the right choices, they must be informed about fire, fire protection and the significance of their movements.

All students should get this kind of information to help them decide on a fire. Overall...

- Get acquainted with the building's alarm and evacuation schedule.
- Count door numbers from the unit to the closest exit (to aid evacuation in the dark)
- Sound the alarm and contact the fire department when you find a fire. •
- If the flame is in your section, exit the zone behind you, shutting all the doors.
- If your section or hall is entered by smoke, you have to choose to leave or to remain. If you depart, be attentive to shifting circumstances and review your position on a frequent basis. If you know that the fire is well below you, remain there.
- Use an alternate escape route to meet smoke or flames

Keep cool and take steps to guard yourself.

- Go to a specific area with external window or veranda if feasible
- Shut all the doors between you and the flame and use the tape and cloths to block the openings.
- Call and inform the fire department precisely where you are.
- Be ready to shut the window when smoke enters if feasible. Don't crash windows. Be patient. Be patient. Training exercise assessment and documentation may also offer information on shortcomings and opportunities for improvement.

**5. Inspection and Maintenance**

In order to maintain the dependability and efficacy of fire safety measures, inspection and maintenance are a key component of fire protection. If fire protection procedures are not routinely examined and kept, the system dependability decreases and may not operate as intended in the case of fire. The university building compliance schedule specifies fire safety systems maintenance and inspection times. The care and review of fire protection procedures vary according to the laws of the individual State. All university buildings should have a maintenance timetable and log books which contain any necessary fire safety measures in the design of fire engineering. Passive guard examination in university buildings is as essential as the review of active structures. The passive

protection of fire and smoke, the escape route for students and other staff and fire brigade, plays an essential role. Construction modifications or revamps that infiltrate or modify passive banier systems may require fire stoppages and a fire engineer must inspect or authorize them. One of the biggest university issues is getting access to inspections and upkeep of individual flats. Because every university building is a separate unit, it is difficult and time consuming to coordinate the inspections. Students and other staff may also sense that inspection is an invade of privacy and are unwilling to accept reviews. In certain instances, the requirement for distinct university inspections may be minimized by the practical proposal of the fire security schemes. For instance, an analog smoke detector addressable structure may be utilized for the control of indicators at the panel, relatively than at each part. Hardwired smoke-detectors may also be utilized to minimize battery-removal or flat issues. Another important field is the examination and maintenance of common spaces and exhaust routes to guarantee that they are clear of fuel materials. The probability of igniting and fire spread may be minimized by proper housekeeping.

**6. Emergency Strategy**

In every structure, an emergency plan is as essential as active and passive fire protection procedures. In the case of a flame, students and other staff should be educated or know what to do, and the right steps should be taken in various circumstances. The phrase "evacuation plan" or "evacuation scheme" was utilized for the development of an emergency tactic historically. The usage of this phrase suggests that students and other staff should leave the university building during an emergency, although it may be a safer option in certain circumstances. The decamp of university buildings may also be problematic owing to the building dimensions and the students' ability. It is thus recommended that the word 'emergency tactic,' or 'emergency approach' should represent the various options for students and other employees in the case of an emergency.

Communication, education and training are an essential part in changing the attitude of residents. The natural thinking of the inhabitants may in certain instances correspond to the emergency plan. For instance, residents may choose to stay in their residences since this is a familiar location and usually a reasonably safe setting. The simpler the approach, the less probable the possibility of misunderstanding and unexpected occupational behaviour, is in each emergency strategy. When feasible a fire safety precaution should incorporate an emergency information system to give instructions, information and reassurances for the inhabitants.

All emergencies rely on passive and active fire systems to guarantee the safety of students and other employees in situations of emergency. In the absence of an active and passive structure, the emergency tactic may be compromised and students & other staff may have to respond to circumstances unforeseen. Sufficient education and training are necessary for the preparation of the inhabitants for unexpected circumstances. Information and occupant reassurances.

Below is a brief explanation of the emergency tactic or the emergency approaches utilized in the matrix.

Evacuation – all students and other staff exit the building on alert.

- Non-evacuation- The building is evacuated by students and employees in the fire room.

Other students and other staff are still in their rooms waiting for help and guidance from the fire department and carrying out on-site protective measures.

- Staged evacuation - First remove students and other staff in the room of fire and on the fire floor. The rest of the inhabitants should leave automatically until the fire department intervenes in the

following procedure. Students and other staff are evacuated following the ones on the flame level, accompanied by the floors above. Students and other employees in levels below the fireplace are last evacuated. Fire brigade involvement may modify the evacuation sequence or stop evacuation due to current circumstances or changes.

**7. Signs**

When required, signs must be utilized to assist individuals in identifying breakout routes, finding flame fighting apparatus and emergency calling systems. However, signage cannot be needed for extremely basic little places when all exits are regularly used and known to everyone (eg, in a small village university). For the signage requirements for evacuation routes see section. To be signed in the form of a pictogram to comply with these regulations. The pictogram may be added to a text if this is thought essential to make it easier to understand the sign, but you should not have a security sign that utilizes just words. The appropriate signals should also take consideration of learners' age and competence.

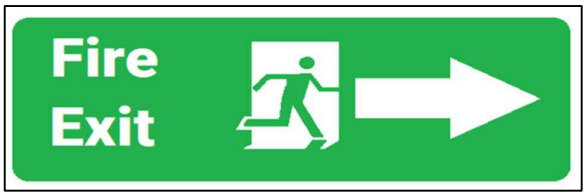



**Figure 3:** Classic Fire Exit Sign

**8. Fire Doors**

Any door on fire-resistant walls is a door to fire and smoke resistance (when closed). Fire shutters are used to partition long passages on escape pathways and ensure that when fire, only a short departure route smoke. The fire doors are also utilized to separate the stairs from traffic lanes to protect the smoke staircase.

Fire doors usually include glass view screens that allow everyone to travel about the building, including individuals with special needs. In the event of a fire, visual panels are also helpful in order to show if smoke on the other side of the area is affected. The degree of vitrification to be used depends on whether or not it offers fire resistance to a required level of isolation and integrity.

Holding open doors on traffic lines will make it possible for workers and students to move freely around the university building. The open holding devices may be incorporated in the closer shutter or bear alone. In any scenario, they have to be linked to the AFD system so that devices release promptly if detectors are operated and doors closed. This guarantees that the divide continues.

Section 3.5 indicates the use of fire doors in the comprehensive design directives.

**9. Fire Drills**

Fire drill is an emergency exercise to be utilized in the event of a fire. Fire drills are designed to ensure everyone understands how to leave safely as soon as possible. Fire drill methods may assist to ensure that pupils are safe quickly and efficiently in the event of a flame, power failure or other catastrophe during class hours.

We should examine the following stages for setting up a fire drill procedure:

- Need to contact the local fire chief or fire-marshal. It is important to arrange a meeting with local emergency workers to discuss best procedures for firefighting and expulsion.

- In-house safety committee must be created. It contains a representative of every class or department intended as a leader in the security team.
- Have evacuation routes to communicate. They need to speak to local fire authorities, create documented evacuation routes and post-evacuation maps around the facility.
- Need to do frequent fire drills. After the initial exercises have been implemented, we may do them bi-weekly or monthly. However, if pupils seem to hang up the procedure, it is ideal to wait between fire drills for longer.

A fire drill is important, since it helps:

- To recall sound and/or vision of fire alarms to employees and pupils, where emergency routes are located, assembly point and any special fire security measures.
- Testing that fire protection systems are working as planned.
- Evaluate how fast individuals can escape from the university.
- Identify locations where individuals cannot see alarms or indicators.
- Give fire guards a chance to do their tasks.
- Test personal evacuation emergency plans.
- Ensure that emergency routes and exits are unimpeded.
- Test the roll calling process of the university.

If AUST wants to practice the fire drill, then at first the authority has to find a time where all students are free from class means they have their class break. Also, last but not least, if the students don't act carefully, then further extra training is needed to beware them about fire accidents.

**Detection**

The primary function of the detection system is to spot fire, to start the alarm and other flame prevention procedures. Exhaust and heat sensors are the utmost common spotting schemes in any university buildings. Smoke detectors typically have a quicker time and are an essential instrument to alert people to smoldering and burning flames. Smoke detectors are one of the most inexpensive methods for preventing fire in university buildings. Smoke spotters may be the only handy flame precaution in the event of smoldering fires. Fires which would not initiate sprinkler systems and passive safety via open doors may be avoided.

There are several types of fire detection schemes existing. The university detection system typically includes a mixture of smoke sensors, heat detectors, sprinklers and manual call points.

There are several detection rules:

- Provision of heat detectors in communal spaces
- Provision of a voids in close proximity to the bathroom
- Provision of smoke detectors in universities
- Provision of hardwired detectors to local alarms linked to university buildings
- Provision of hardwired detectors in corridors related to campus alarms and alerted devices in general areas
- Provision of campus local alarm.

Current analog-addressable detection systems offer numerous advantages compared to traditional systems. However, these advantages must be balanced against system expenses. The advantages of an analog adjustable scheme are:

- Specific spotters may be acknowledged.
- Detectors status may be observed and changed

The sensitivity of the detector may be changed

- Heat and smoke detectors may be replaced by specific systems.

**Automatic fire, alarms and communication detection**

While students and other staff may expect a burn to start or smell smoke, this is not a dependable means of spotting. Early automatic detection and fire alarm will allow the population to escape quickly and safely or to face fire early in development. This provides quick professional assistance to minimize harm to university building materials and content (s).

Automatic flame detection may be connected to other structures for their operation to be enabled. Samples include open-fire devices, smoke extraction or ventilation techniques, removal techniques and aeration pipeline fired dampers.

Section 3.2 gives direction on the use of fire detection and alarms for special design benefits. Automatic Category P systems are intended to defend assets and Category L schemes to defend life. Category M is the manual calling method for spoiled glass points and sounders. A completely automatic zonal fire sensing technique with a straight connection to a central station is the best system to get Fire and Rescue Service to participate quickly, especially during university hours. However, a 999 call under the Fire Services Act 2004 might require verification, since it aims to minimize the number of people who are existing in the event of false alarms.

During the design phase fake alarms may be substantially prevented by careful selection of the detector type, detection position, system set-up and security system connection.

**Emergency Lighting**

To make fire alarm locations and firefighting equipment easy to locate, emergency lighting impact is high. When a fire alert sounds unexpected and a fire spreads across the structure, a feeling of fear may create confusion as many starts to forget about fire protocols in their buildings. A sudden black fire only enhances confusion and therefore raises the danger of injury or death. A clear path with lighting will facilitate the safe departure of the building in the case of a flame. A well-designed emergency lighting technique is essential to preserve life.

Making sure your flashing is powered adequately is an essential aspect in selecting the appropriate system for your university building. Legally, once the main power has gone, light must remain for one full hour. A small red LED is common to see that the light is "active," and in the event of an emergency occurs.

**Stairs to Escape and Passage to Escape**

(1) Escape and escape stairways shall be constructed and no fuel shall be provided in the escape lobby. Individual mechanical smoke exhaust systems and natural smoke exhaust systems with opening areas covering no more than 5% of room size should be installed in order to provide people with safe escape from the escape stairs.

(2) The staircase and fire-lift should be constructed on the escape steps for two-way evacuation.

(3) Notices should be placed indicating the position of the fire-lift in the exhaust stairway and continuous evacuation signs along the route. An emergency light should also be present. The escape route is right.

(4) The fire wall shall be used to divide the escape from the next shaft, stairway, entrance or floor of the elevator, with a fire resistor of a minimum of 3.0 hours. The openings should be covered by a fire door if the firewall is opening.

(5) The steel truss on the escape stair should be protected by fire in order to ensure the safety of the steel structure.

**Number of Breakout and Exit Routes**

Multi-storage buildings like universities may require more than one staircase, so that each part of each floor must have access to more than one staircase. There is no prohibition on places in dead ends, so long as the alternative staircase is accessible if the first is not functional. Different sections of the structure require alternative escape routes to prevent students and other staff being caught by fire or smoke.

In maximum cases, there will be no alternate at the start of the journey. For instance, only one departure from the area to the hallway is possible from which the escape points can be reached by.

Very young people proceed sluggishly and need constant monitoring and management during graduation compared to older children or adults. The provision of direct access to an outdoor location should be taken into account from its classrooms.

**First Aid Fire Fighting Equipment**

The supply of fire extinguishers for first aid is not regulated in the Building Protocols. However, flame extinguishers can play a life-safe role if they are effectively taken away in the safest way from the consequences of fire. Fire extinguishers also have a clear goods safety function if the flame can be dealt with before it gets too huge. Designers should consider providing initial aid flame control apparatus because this may involve university building wall loading niches, to give just one example.

**Movement of Smoke and Its Effect on Escapes**

Early in the fire, smoke and other combustion products will have the greatest impact on the population. Typically, smoke is the first thing the people see and is usually the source of the first alert. Smoke tends to collect from top to bottom at a ceiling level, i.e. smoke registration, if there are no significant air currents. Once down the top people cannot see very far because of the smoke density and the hostile impact on the eyes. Breathing will be tough as carbon dioxide stages rise to an increased breathing amount and exhaust becomes less and less oxygen. The effects are very rapid for younger students who are still breathing, which lead to respiratory discomfort, as smoke becomes warm and ultimately unconscious or death from carbon monoxide toxicity.

It is important to recognize these situations when dealing with different age groups that know the structure but aren't very moveable for a number of causes. Legislative limitations are naturally taken into account by adults. Whilst students and other staff can comply, university planners and university buildings users must look at younger, smaller and shorter students in the design stage so that everybody can leave safely irrespective of stage, size and disorder.

It is therefore vital to protect breakout routes from smoke penetration and get to the story or ultimate exit before it gets unsustainable. If the visibility falls below 10 m it will be impossible to proceed

safely to the exits. Factors like the existing furnishings, exit size and student age and mobility must also be taken into account in the time required.

All appropriate safeguards must therefore be provided to allow a safe exit from any section of the structure.

**Smoke Handle:**

There are four key motives for controlling smoke spread: protecting escape routes, fire-fighting aid, reducing the risk to people in areas not close to the fire and minimizing smoke damage to building materials and materials. In maximum cases, this is accomplished with containment procedures such as doors and walls. However, in certain situations, exhaust ventilation techniques or pressure techniques may be required or beneficial. Smoke ventilation techniques may take longer to smoke to create situations that are life threatening when space is recorded. The capacity of the classroom, the stature of the ceiling and the dimensions of the flame depend. In order to meet building regulations, the comprehensive design guidelines require some kind of smoke ventilation from cellars. This is helping firefighters. Smoke control in other sections of this comprehensive advice is optional for various reasons. Smoke contaminates sensitive ICT equipment and books in addition to the abovementioned danger to life protection. Smoke control may therefore have to be considered as a protection measure of property. Some ductworks/louvers should be part of the ventilation system in all new or existing university buildings. When crossing a university building wall that has a designated flame resistance, it must not affect that fire resistance. An appropriate detecting system to control a ventilation system designed to remove any smoke from a fire.

**Additional Automatic Flame Removal Systems**

Flame suppression schemes may cover the entire university, such as sprinkler systems, or supply systems like gaseous or water-burning systems that target recognized risks in a given area.

Many alternative or novel methods of fire removal are available. When used, such systems must be developed, tested and tailored for use in university buildings. Most of these systems cannot be used in the classroom.

Construction restricting fire and smoke has three main objectives:

- prevent fire or smokes spreading to protected streets;
- insulate areas that are identified as hazardous zones or zones serious to the operation of universities in the risk assessment;
- reduce uneven harm to universities as an outcome of fire and smoke spread to protected routes;

Most specific design guidelines in subsequent parts focus more or less on restricting the propagation of fire and smoke.

The flame resistance can be described in three components: structural (load-bearing) integrity (E) or isolation (I)

Comparison not only acts as a barricade to flame and smoke, but this is the main task. University building dimensions also offer a certain amount of fire load handle over a compartment (usually based on floor space and room use) and consequently on fire severity.

**Further Inevitable Steps:**

We should also take steps that everyone doesn't notice so well, but are important in reducing fire accidents in university buildings.

Take the following as:

**1. Preventing Unauthorized Building Access**

The border safety form should be selected to fit the place and level of danger of the university. Access to the site should be restricted, preferably and access from nearby university buildings or barriers should be prohibited.

Doors and frames with strong door and window locks can be built and installed to keep attackers at loss.

There should be a restricted number of entries to the place and university buildings. In specific, the digit of hidden intruders or regions should be kept to a minimum. Landscape can be used without covering invaders to improve the structure. Access to roofs should be banned. The exterior of the building should be brightly illuminated, especially in concealed or vulnerable places.

CCTV monitoring can be used as a deterrent, but some insurers believe that it can only be helpful if the security staff are constantly monitored to react quickly. Similar criticisms are employed to the utilization of safety alarms.

**2. Reduce the chance of an offender causing a fire**

Waste vessels should be kept away from buildings, university entrances and exits in closed areas.

Fuel materials in secure areas, classrooms, labs etc. should be stored within the structure. All storerooms, employees' facilities, dean offices and general workplace spaces should be protected from opposing entry at the close of the working day.Fuel or scrap in safe, sealed storage should be stored away from university buildings.

**3. Reduce the extent of possible fire damage**

The connection of a removal system (e.g. sprinklers) is expected to be extremely useful in minimizing bronze effects.

Automatic flame and alarm techniques can be useful when the university building is working, provided initial aid flame control (eg, extinguishers).

When the mutual space in the buildings is vacant, the Fire and Rescue Service can respond to a fire as quickly as possible by connecting a fire detection system to an alarm reception center.

Cloakrooms are locations of comparatively frequent incendiary attacks. They should be considered as unique areas of fire risk.

The external shell of university buildings can decrease their susceptibility to fire attacks. The installation in and outside of windows of the standard laminated safety glass may prevent unauthorized entry and the risk for incense damages caused by burning items which are thrown into the structure. In particular, such precautions can be used in risky places such as computer rooms, laboratories, and storage ranges. However, it should be stressed that such conventional safety glass covers are not very resistant to flame.

Left-over tanks under windows and under fuel eaves should not be installed wall-mounted.

**4. Protected circuits of power**

Where the continued operation of electric circuits during a fire is essential, safe circuits are needed. The risk of damage to protected circuit cables should be minimized using robust cables, careful cable

selection, and/or physical protection where cable harm can occur. Usually cable support methods should be non-fuel and should not decrease the completeness of the circuit below that of the cable. A protected circuit for fire equipment shall be a cable which, when verified in BS EN 5200:2006, meets at least the PH 30 classification criteria, or a standard equivalent. It should follow a path chosen only to cross sections of the structure, where the hazard of fire is minimal and is different from any other circuit.

There may be fire prevention systems like sprinklers in large or complicated structures that have to operate for a long time during a fire.

**5. Air conditioning systems and machine-driven ventilation techniques**

Any machine-driven ventilation techniques should be plotted to prevent conduit from fire or smoke transportation into the structure and to endanger the protected exhaust routes from accommodation areas in a fire environment. Each exhaust station should be located in order to prevent further threats to the university building, such as from final exits, fuel insulation or rooftops and the entrances to the structure. Other locations should also not be operated by the ventilation tubes providing or removing air straight from or to the secured exhaust path. A distinct ventilation technique should be installed for individually secured stairs. Where the pipeline operates further than one portion of a subdivided escape path, a flame damper is installed where the pipeline is entering each of the escape route components that operate the smoking or appropriate fire spotting techniques. The flame dampers should shut when smoke is spotted. Ducts with a secured departure route should be fire resistant.

In the case of air-recirculating systems, smoke detectors should be placed on the extraction duct before recirculating air and air are discharged in the unclose air and before strainers and air cleaning apparatus are discharged. Such detectors should: (a) cause the structure to close down immediately; unless precisely planned for smoke collection, mechanical ventilation should be stopped as soon as smoke is found in the channel or the fire alarm has been operated. Non-home kitchenettes and floor spaces should not be recycled by separate and autonomous extraction systems.

If a compression difference technique is built, then the ventilation and the air conditioning equipment must be compatible with the university building system during fire work.

**6. Safety and arson prevention**

Increasingly, fire safety, especially incense protection, is intimately connected with building and site safety. Excellent safety and good cleaning means that the opportunist fire breaker can inflict very little harm. Universities are aimed against theft, vandalism and deliberate burning. The requirements outlined in the box below are aimed at ensuring that the intruders do not enter the university building and, consequently, reduce incense. The Chief Police Officers' Association and the British Insurers Association accept these criteria (ABI)

**7. Sprinkler Techniques**

Sprinkler techniques in university buildings can minimize life hazards and substantially reduce fire damage. Sprinkler protection may sometimes also be used as a compensation element if the requirements of this text are changed. Sprinkler protection across the university building is a common practice when sprinklers are supplied. However, if the rotors are set aside for compensation to mark a certain hazard, it may be appropriate to guard only certain portions of the structure.

It is known that sprinklers are very efficient in suppressing fire, but are still small, and definitely will gain time before the Fire and Rescue Services arrives and will also create less dangerous conditions

for firemen. The sprinkler top reacts like a thermometer, as if it is submerged in the heated smoke. It warms the entire top and expands the fluid in the glass bulb, so that the water is pumped out of the sprinkler and supplied in the form of a parachute. The heads closest to the fire are usually first heated and should fall on the flames when the water is spraying out and will hopefully expel. Notice that this differs from the total involvement of sprinklers, which is misleadingly displayed in movies and publicity. While the fire isn't destroyed (e.g. protected from sprinkler spray), soaking in the environment should keep the fire from expanding further.

When a university building-wide suppression system is implemented, there are heat sensors throughout the university that can save money. Sprinkler systems include flow meters for alarm.

The good practice recognized and advocated by the industry is to use sprinklers with a balance between different and complementary methods in the context of an integrated fire protection concept. The optimal sprinkler function also depends on the complete system maintenance, water supply security and feeding and pipeline fire protection. This is an essential part of any design risk evaluation.

**8.Warnings for hearing impaired individuals**

In universities a suitable warning mechanism (e.g. visual or hearing fire alarm) should be used if one or more people with hearing impairments should be isolated, and there is no other method of warning acceptable.

An emergency light system may be more suited than permanent beacons in many cases. This can possibly be utilized to warn people with hearing disorders. By the way, Clause 18 of BS 5839-1:2002 gives extensive advice on the strategy and choice of fire alarms for disabled persons.

**9. Reduce future losses and disruptions of fire**

If the fire can remain small, losses and disturbances are minimized, the precautions in the last section are therefore useful too.

Restraint of the fire in its source could be successfully promoted through sound and strong architecture and construction based on compartment principles. Sprinkler also works best when combined with a fire safety base based on a split, solid building.

By keeping valuable equipment in areas/containers fire resistant. Computer files and copies of important documents need to be backed up (not in the same place as the originals). A strategy for fire recovery is also recommended (not just for arson)

## 3. CONCLUSION & RECOMMENDATIONS

The authorities of the university should create and execute fire safety initiatives that emphasize education and prevention. It is important that students get the chance to put what they have learned about fire safety into practice. The following fire safety management responsibilities should be performed by university housekeeping staff in conjunction with the local fire safety department and in collaboration with faculty:

- Identify and eliminate potential fire dangers.
- Conduct fire safety inspections, ideally once a term, and do more often informal checks to ensure that fire safety guidelines are being followed.
- Designate staff members who are well-versed in fire safety to serve as fire wardens.

- Additionally, make sure your workers understand and adhere to all applicable fire safety rules.
- Do regular fire drills that include instructors and students.

Other further solutions are:

(1) Steps to link should be taken to ensure that, if a fire occurs, lifts up and down automatically descend to the lower level (fire drain on the top and the bottom floors of the upper floors);

(2) The ducts inside the lift shafts should be stopped on each level by fire. Fire door should protect doors for maintenance.

(3) Fire extinctors should be placed in the foyer and in any university building that may be used for early-stage fires.

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