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Fire Safety Assessment for Educational Building in India

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Abstract: ***India is a developing country with lot of infrastructure and communication system. There are large amount of heavy structures which contribute to provide employment to lot of people in the metropolitan as well as Cosmo metropolitan cities. In such cities which contribute a lot of public buildings are planned and designed to fit the purpose they served, but there is no such evidence that these structures may or may not be designed as per the requirement of fire safety. The proper planning according to fire resistant construction means providing compartmentation, means of escape for occupants and means of access for fire fighters. The objectives of such planning and construction are to reduce the accidental fire by using fire proof materials and techniques and guidelines in IS codes. Even if fire occurs then small amount of heat should be liberated. The spread of fire should be slow and it confined within space of origin without affecting adjacent places. And the building structure should be able to stand for some time so that occupants can evacuate. This paper aims to study fire and safety for every Educational building. Nobody cares for fire safety for many years. Intensity of fire is depending on the amount of combustibles and the number of people staying inside the building. Some important points related to fire & safety of public buildings is focused in this paper.***

Keywords: Fire, Fire safety assessment, Firefighting Equipment, Fire &life safety

1. Introduction

Fire is one of the major hazards which may occur due to natural or man-made causes. In general, fires may be classified into five categories depending on the fuel that is burning. In recent times, there is an increase in incidences of fires in urban population due to very densely populated areas. The losses associated due to fires can be classified as loss to the life of structure, loss of human life and loss to property. It was observed that many options are available which help in early detection of fire and minimizing the losses. Smoke detectors and fire fighting equipments were studied for a public building i.e. an educational institution. Analysis of fire loads of different compartments and providing sufficient number of fire fighting equipments can help in reducing the severity of fires.

2. Characteristic of Fire

Fires start when a flammable and/or a combustible material, in combination with a sufficient quantity of an oxidizer such as oxygen gas or another oxygen-rich compound (though non-oxygen oxidizers exist that can replace oxygen), is exposed to a source of heat or ambient temperature above the flash point for the fuel/oxidizer mix, and is able to sustain a rate of rapid oxidation that produces a chain reaction. This is commonly called the fire tetrahedron. Fire cannot exist without all of these elements in place and in the right proportions. For example, a flammable liquid will start burning only if the fuel and oxygen are in the right proportions. Some fuel-oxygen mixes may require a catalyst, a substance that is not directly involved in any chemical reaction during combustion, but which enables the reactants to combust more readily. Once ignited, a chain reaction must take place whereby can sustain their own heat by the further release of heat energy in the process of combustion and may propagate, provided there is a continuous supply of an oxidizer and fuel.

If the oxidizer is oxygen from the surrounding air, the presence of a force of gravity or of some similar force caused by acceleration is necessary to produce convection. Which remove combustion products and brings supply of oxygen to the fire. Without gravity, a fire rapidly surrounds itself with its own combustion products and non-oxidizing gases from the air, which exclude oxygen and extinguish it. Because of this, the risk of fire in a spacecraft is small when it is coasting in inertial flight. Of course, this does not apply if oxygen is supplied to the fire by some process other than thermal convection.

In case of fire

- Do not panic; keep calm.
- Actuate the manual fire alarm system provided on the floor to raise alarm.
- Think and act quickly.
- Report to security.
- Summon the Fire Brigade on known telephone No. 101
- Alert the people in the vicinity of fire.
- Do not take shelter in the toilet.
- Fight the fire only if you can. Do not take undue risk.
- Crawl, in case you encounter smoke.

Do's

- Acquaint yourself with the layout of the escape routes, staircases, refuge areas and the location of fire alarms.
- Train yourself and the security personnel in the proper operation and use of first-aid hose reel provided at each floor level and fire extinguishers. Also train them in switching on the fire pump, at ground/basement level and also the booster pump at terrace level, and the method of summoning the Fire Brigade Department in the event of a fire.
- Keep always closed the fire doors of staircases, main entrance to the factory building/ company

- All the fire protection installations such as fire pumps, wet riser-cum-down comer, sprinkler installation, fire extinguishers etc should be kept in a good state. Timely use of these will help in controlling/extinguishing the fires in the early stages, thereby minimizing life losses and property losses.
- Always maintain good housekeeping.
- Ground all the lifts, including FIRE LIFT, in case of a fire.
- Practice evacuation drills periodically.
- Irrespective of the magnitude of fire, summon the Fire Brigade at the earliest.
- Seek the advice and guidance of Fire Brigade Department in the matter of fire safety.
- In case of fire, guide the Fire Brigade Department personnel about the location and extent of fire, information about trapped persons, if any, and provide any other information they may request. Help them to help you.
- Remember, FIREMAN IS YOUR FRIEND.

Don'ts

- Do not allow encroachments or storages in the courtyards of the building. Open courtyards are required for placing and operating the fire and rescue appliances in case of emergency.
- Do not allow storages or obstructions in the common corridors and staircases. These exit routes, if maintained clear, will help easy escape in case of fire.
- Do not allow the Fire doors of the staircases to be kept open. In case of fire, heat and smoke enters the staircases and prevent the escape of people.
- In case of fire, do not use LIFTS for escape. They may fail midway trapping people inside. Use only staircases.
- Do not allow Electric Meter Rooms to be used as storages, dumping places or as living quarters for servants. They are potential fire hazards.
- During Diwali Season, do not keep any combustibles in the balconies. Do not dry clothes in the balconies or outside the building line. Flying crackers have caused serious fires.
- Do not use the basement for any purpose other than permitted purpose. Because of ill-ventilation, habitation or working in the basement will make a death trap for people.
- Continuous electrical ducts through the height of the building enable the fire to spread from one floor to another. Seal them at each floor slab level.
- Do not allow Air-Condition ducting to pass through one floor to another, because fire, heat and smoke travel through these ducts and spread to the other part of the building. Sectionalize them, as far as practical even on a particular floor, so as to limit the spread of fire, heat and smoke, and minimize the damages.
- Never paint or coat fire detectors or sprinkler heads. If done, they will become ineffective.
- Do not re-enter the ire affected building to collect the valuables or for any other purpose. It may cost your life.

To prevent fire -

- Do not overload electrical circuit; it may cause short circuit and a fire.
- Use one socket for electrical appliances
- Do not leave electrical appliances unattended.
- Switch off electric appliances after use and remove the socket. It is fire safe practice.
- Switch off the "Main switch" before the house for long time duration.
- Do not keep electric wiring hanging, batten properly.
- Do not uses candle the in case of power failure User battery operated torches
- Smoke only in the Smoking Zone, use non- combustible ashtrays for depositing lighted smoking material
- Use ashtray while Smoking
- Keep matches, crackers, and lighters away from the children.
- Keep L.P.G. Stove/Segre/Burner on raised non-combustible platform.
- Turn off the L.P.G. gas cylinder valve and burner knob of the gas Segre/cooking range etc. when not in use after cooking.
- Ventilate the entire room if L.P.G. cylinder is leaking and do not switch on/off any of the electric switches the room in. Replace L.P.G. supply tube periodically or as and when advised by Mechanic.
- If L.P.G. cylinder is leaking-
  a) Close the main cylinder valve.
  b) Ventilate the entire room.
  c) Do not operate electric switch.
- Do not allow children to play with fire crackers.
- Do not light fireworks very close to the buildings.
- Close the windows and openings properly to prevent ingress of lighted flying crackers.
- Do not leave lighted oil lamps, agarbattis or candles on the floor or near combustible material. Put them off before retiring to bed.
- Do not store scrap/combustible material in and around the building; dispose it regularly

3. Fire Resistance Requirements

One of the major safety requirements in building design is the provision of appropriate fire resistance to structural members. The basic for this requirement can be attributed to the fact that, when other measures of containing the fire fail, structural member (system) exhibits resistance with respect to structural integrity, stability, and temperature transmission. Fire resistance can play a crucial role in buildings as seen in the collapse of WTC the towers and surrounding buildings as a result of the September 11 incidents. Many older buildings were generally built with larger cross-sectional areas (required by structural design considerations alone), and with traditional materials such as concrete and masonry, which enhanced the fireproofing capacity of the buildings. However, in modern buildings, the use of HPM, together with large cross- sectional areas (required by structure design considerations alone) and with traditional materials such as concrete and masonry which enhanced the fireproofing capacity of the building, However, in mode buildings the uses of HPM together with sophisticated design techniques based on nonlinear methods of analysis aimed at optimizing the structure design often land to thin structural members, that might result in lower fire resistance characteristics. Hence, there is an urgent need for

establishing the fire resistance of structural system made of HPM.

4. Fire Assessment

A fire risk assessment is an organized and methodological look at our premises, the activities carried on there and the likelihood that a fire could start and cause harm to those in and around the premises. The aims of the fire risk assessment are:

- To identify the fire hazards.
- To reduce the risk of those hazards causing harm to as low as reasonably practicable.
- To decide what physical fire precautions and management arrangements are necessary to ensure the safety of people in our premises if a fire does start.
- The terms 'hazard' and 'risk' are important that we have a clear understanding of how these should be used.
- Hazard: anything that has the potential to cause harm.
- Risk: the chance of that harms occurring

If an organization employs five or more people, or our premises are licensed or an alterations notice requiring it is in force, then the significant findings of the fire Risk assessment, the actions to be taken as a result of the assessment and details of anyone especially at risk must be recorded, We will probably find it helpful to keep a record of the significant findings of our fire risk assessment even if we are not required to do so.

5. Classification of building as per IS Code

Classification of building is done on the basis of fire load. The fire load is determined by multiplying the weight of all combustible materials by their calorific values and dividing the figure by the floor area under consideration. Buildings are classified according to the use or the character of occupancy as follows

Group	Type of Building
Group A	Residential
Group B	Educational
Group C	Institutional
Group D	Assembly
Group E	Business
Group F	Mercantile
Group G	Industrial
Group H	Storage
Group J	Hazardous

Classification of fire as per IS Code

For all practical purposes, the basic types of fires can be grouped into following four classes:

a) *Class A fires* — Fires involving solid combustible materials of organic nature such as wood, paper, rubber, plastics, etc, where the cooling effect of water is essential for extinction of fires.

b) *Class B fires* — Fires involving flammable liquids or liquefiable solids or the like where
a blanketing effect is essential.

c) *Class C fires* — Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate with an inert gas, powder or vaporizing liquid for extinguishment.

d) *Class D fires* — Fires involving combustible metals, such as magnesium, aluminum, zinc, sodium, potassium, etc, when the burring metals are reactive to water and water containing agents and in certain cases carbon dioxide, halogenated hydrocarbons and ordinary dry powders. These fires require special media and techniques to extinguish.

6. Fire Fighting Equipments

As per fire hazards mainly fire fighting equipments which are required as per IS code listed below for every equipment installation there is separate Is code provided.

1) Fire Extingunsher
2) Smoke detector System
3) Fire Alarm System
4) Hose reels
5) Automatic water sprinkler system
6) Fire Hydrants
7) Fire Bucket
8) Exit signs

7. Case Study

In India, buildings were categorized in to different building categories including residential buildings ,industry buildings, pub- lic buildings and institutional .Fire occurrences from2009to till date frequently..Average fire risk in educational or institutional buildings is more. The average frequency of public building fire occurrence canbe obtained by dividing the number of fires by the total floor areas from2007to till date.

As we see educational buildings in india there is no any provision for fire and life safety. Minimum 2 fire Extiguishers are required per 100 m2 area. DCP type fire extinguishers are more suitable as per cost economics and fire hazards. internal or external fire hydrant system should be required for class A type fire. As fire catches, smoke detectors are one that gives the information, right at initiation of that fire. More precisely, smoke detectors are more suitable for night time. Because, it is more sensitive to smoke detection. The building under study contains large number of occupants. So public address system must be there for life and safety.

8. Conclusion

It is observed that the construction and design engineers are quite good in planning the building from construction point of view. When these designs are compared with those prescribed by the IS codes, it is observed that norms are followed from construction point of view.But when we look for the fire and safety provisions it is clear from the study that fire safety measures are not provided in the building. This increases the chance of fire hazard taking place, which may cause severe damage to life and property. Each and

every aspect of fire safety is considered in this paper. There is intense need of applying fire and safety plan for the life and property

References

[1] C.L.Chow and W.K.Chow, (2003) "Assessing Fire Safety Provisions For Satisfying Green Or Sustainable Building Design Criteria: Preliminary Suggestions."*International Journal On architectural Science*. 2003, 4(3); 141-146.
[2] HOU Long-Fei , Lie Ming, CUI Wu-Yuan LIU YU-chen , (200) "Numerical Simulation and Analysis of On-building High-rise Building Fires." *Procedia Engineering*. 2011, 11; 127-134
[3] National building code of India part 4 FIRE AND LIFE SAFETY
[4] IS 1641-1988 code of practice for fire safety of building
[5] IS1642 1989 Code of practice for details of construction
[6] IS2190-2010 C.ode of practice for hose reel
[7] IS 2189-2008 code of practice for automatic fire alarm system
[8] IS3844 1989 for fire hydrant system
[9] National institute of fire and safety www.nifs.com