



Enhancing Fire Safety Methods in Buildings

KEYWORDS

1. Combustion – Fire, 2. Ignition source – fire source, 3. Occupants – User of the building.

Mr. M. Sivashanmugam

Research Guide, Chief planner, Chennai Metropolitan Development Authority, Chennai, Tamil Nadu. India

Mrs. Lilly Grace Murali. P

Architect, Research Scholar of Sathyabama University, Chennai, Tamil Nadu, India.

ABSTRACT *Fire accident in buildings is a threatening one now a day. The numbers of accidents are increasing in day by day. It creates heavy lives and property losses to the individuals and the nations. To find out the reasons, frequency and giving protection to all type of buildings became challenges to the professionals. A detailed study with analysis required to seek the solution. In this paper the existing fire safety methods are discussed. The last twelve years number of fire accidents, property loss and lives losses are taken as survey. These statistical data are analyzed. The results are discussed. These results give the gap in between the existing fire safety methods and the number of accidents and its impact existence. Therefore to patch up the gap, few practical fires prevention methods, system and practical trainings are recommended to practice in side of the building. These recommendations will definitely bring the buildings under safer fire zone in future.*

1. INTRODUCTION

Fire or combustion is the process of burning. It is a chemical reaction initiated by presence of heat energy in which a substance combines with oxygen in the air and the process is accompanied by emission of energy in the form of heat, light and sound. Fire Accident is an unplanned or unexpected event in the building environment. We know that, the fire occurrence and its continuity needs the direct contact of ignition source with fuel and the continuous supply of oxygen. During the fire in the buildings the fuel or the combustible materials plays an important role. These materials distinguish the type of fire, severity, density and its spread. This distinction depends on the nature, quantity, arrangement of combustible materials and the way it is burning in the fire. Based on the thermal behaviour of the materials the fires are classified as 1. Solid fire, 2. Liquid fire, 3. Gas fire, 4. Metal fire and 5. Electrical fire. According to the classification of above said fires are extinguished by, 1. Applying water, 2. Smothering atmosphere, 3. Applying gas powder or Vaporising liquid, 4. Application of dry powders and 5. by Electrical dis - connection respectively.

The quantity of combustible materials which are stored in side of the building will be expressed in terms of fire load. If the fire load distribution is continuous, the fire propagation will start from one end to the other end of the load in the buildings.

1.1 FIRE LOAD CALCULATION: Fire load is calculated by multiplying the weight of all combustible materials by their calorific values with area or volume of the building. If the fire load value is divided by the floor area will give the density of the fire load on each floor. The summing of the density value of all floors will give the total fire load of that particular building. This amount is a threat or warning of that building giving towards to the professionals. Therefore based on the amount of threat, processes going in side of the building the professionals have to counter act by applying different fire safety methods by the way of, planning the building, designing the building structure, maintaining the water facility equivalent to fire threat, installing the correct type of fire fighting apparatus and other components at appropriate places. The above said system or the methods of fire fighting by the fire professionals are to be fixed before functioning the buildings. As we all know that fire is one of the basic resource, without fire we cannot live in the modern materialised life, but it should be in the controllable limit for application, when it exceeds its limits it will cause heavy human casualties,

property damage affecting the building, plant, machinery, furniture fittings, electrical equipment and the surrounding environment. Therefore need and control of the fire has to be managed wisely in the buildings.

1.2 NECESSITY OF FIRE SAFETY IN BUILDINGS:

Rapid industrial growth, large migrations towards urban, metropolitan area, limited existence, and high cost of land, availability of city in frastructure buying and occupying the building has become grate task in life. Moreover the modern city buildings forms are of high rise developments. The vertical growth of the building is number of times high as compared to its horizontal occupation. It gives a cubical confined space from ground floor to top floor. Large population and valuables are accommodated in all type of occupancies. Multi functioning of buildings also allowed all places. Therefore the life safety, property safety and processes safety of the building gains Paramount important. The above said modern constrains demands the professionals to implementing the absolute fire safety methods in buildings and it should become mandatory for all type of buildings. The general classifications of buildings are of Residential, Educational, Institutional, Assembly, Commercial, Industrial, Storage, and Hazardous.

1.3 CODES AND LOCAL BYE- LAWS:

A wide variety of rules and regulations are existing regarding the fire safety methods in buildings both nationally and internationally. All are based on the same theme, but they differ vastly in their method of applications. They are broadly divided into two types. The first One is Mandatory regulation and second one is recommendatory regulations. Mandatory regulations, which are introduced by local administrations like municipal corporations or by the State Governments. Recommendatory regulations are available in International, National code books. These codes deal with the safety from fire. It specifies the demarcation of fire zones, restriction on construction of buildings on the zones, classification of buildings based on its occupancy, type of building construction according to fire resistance of structural fire and non- structural components. Mainly it insists to minimize the danger to life from fire, smoke, fumes or panic before the building can be evacuated. All codes are recognizes that safety is more than a matter of means of exits.

1.4 EXISTING FIRE SAFETY METHODS

There are following three types of fire safety methods in

buildings which are in practice; The first one is Fire prevention method, The second one is Fire protection method and the third one is Fire reaction method.

FIRE PREVENTION METHOD: This method is a passive one. It should take care during planning of the building and designing of the building structure. It does not need any energy consumption for activation. It will directly affect the architecture and construction value of a building. The sole aim is to not allow the spreading of, heat, fumes, fire and the toxic substance from the origination point to other part of the building. The building itself has to react with the fire by its construction of materials and the type of constructions. The building has the ability to reduce the volume or size of the fire, fumes and other toxic substances at the incipient point. The components of fire preventions methods are of: Building Access, Building Materials, Building Design, Building Construction types and Building Maintenance. The main objectives of these components are should give insulation effect, stability and integrity of the buildings

FIRE PROTECTION METHOD: This method is an active one. It depends on the selecting the correct type of fire fighting equipments and its components. Installation on the building and the maintenance of its working condition. It is an extra one or bonus one to be attached in the buildings. The type of equipment installation its function depends on the type and the function or the processes going inside of the building.. The components are of: First Aid Fire Extinguishers, Hose Reel Assembly system, Down Comer, Wet Riser system, Automatic Fire Detection and Fire Alarm System, Water Sprinkler System, Automatic Smoke vent Mechanism, emergency lights, Integrated Building Management and Public Address system. The sole aim of this method is to extinguish the fire at the incipient stage itself to minimize the damage of property and buildings

FIRE REACTION METHOD: The objective of fire reaction method is to make the first responders to be capable and also effective in handling emergencies to safe guard life of their own and others. The fire reaction plan or Emergency plan aims to deal with the well organized behavior of occupants, who are supposed to react to any emergency incidents. Emergency plan having the following inter related key elements. Emergency Type, Level, Equipment, Leadership structure, Response procedure, Personal protective Equipment, Operation Centre, Call numbers and contact Persons, Communication System, Evacuation Practice and Response training.

2. MATERIALS AND METHODS:

The following Table: 1 gives the statistical data of number of major, minor fire accidents, property losses and human lives losses in Tamil Nadu from 2000 to 2011.

**ANALYSIS:
FROM THE STATISTICAL DATA**

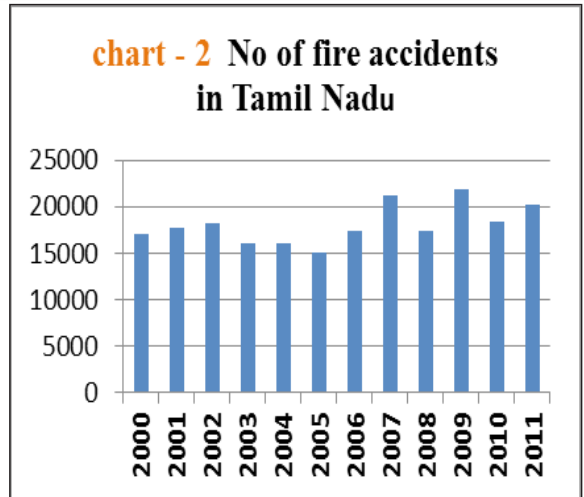
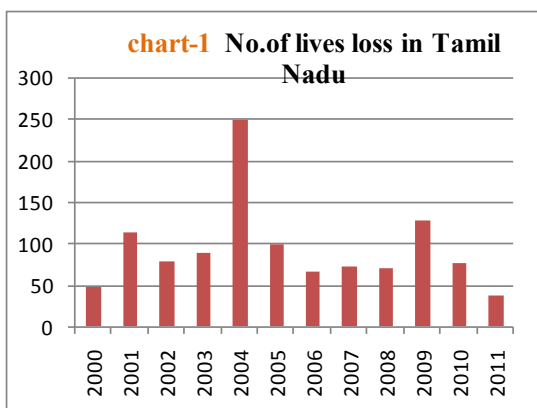


Chart -3: No. of property loss in Tamil Nadu

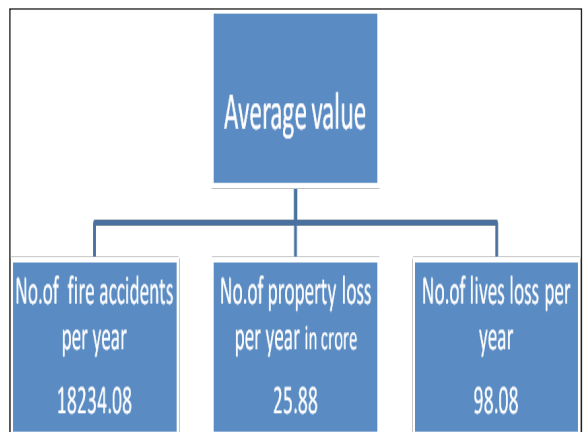
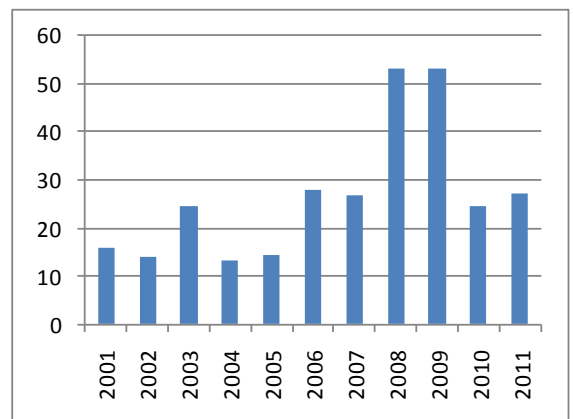


Table: 1 STATISTICAL DATA

year	Number of fire Accidents	Property loss in crores	Human loss
2000	16987	13.64	47
2001	17697	15.79	112
2002	18264	14.10	79
2003	16109	24.57	89
2004	16136	13.07	249
2005	15093	14.2	99
2006	17442	27.74	65

2007	21224	28.87	72
2008	17433	53.17	69
2009	21840	53.17	127
2010	18311	24.60	75
2011	22273	27.59	84
Total	218809	310.51	1177

Source: Tamil Nadu Fire cum Rescue Services

2.1 RESULTS WITH DISCUSSION: From the statistical data analysis: the total number of fire accidents, property loss and lives losses, the average values are calculated. Graphs are prepared on every year reading.

From the number of fire accidents analysis: The graph columns showing the value of 15000 and above. Every year the number is increasing. The average value is 18234.08 per year. It is a huge threatening figure

From the property loss analysis: The graph columns showing rupees 19 crore and above. After the year 2005 the amount was vastly increasing. During the years 2008 & 2009 the amount reached above 50 crore. The average amount of rupees 25.88 crore per year.

From the lives loss analysis; The graph columns shows above 100 lives loss during the years of 2001, 2004, 2005 & 2009. The average number of live loss is 98.08 per year. During the year 2004 the column shows above 250 lives losses. This is due the two major cruel, pathetic accidents which are took placed at Kumbakonnam and at Srirangam in Tamil Nadu state on that year.

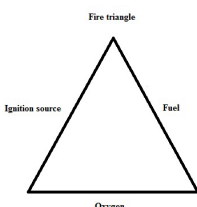
All above said three fire safety methods are in practice and are reviewed at equal intervals. Applications of these methods are mandatory in all state and countries.

But the survey details graph analysis and the average vales shows that the existing practice are not met the objectives or not enough to bring fire safety in buildings. The reasons may be these methods are applicable after occurrences of the fire in the building but it is not applicable to avoid the fire before occurrences. The hazards assessment, possibilities of fire occurrences and other factors are not covered in those methods. Therefore some possible practical solutions are recommended here based on many case studies, basic book resources, discussion with the fire professional. Which are of Fire hazard and fire risk management system, practical training, recommendations for younger generation towards future fire safety and integrated administrative system for high rise, tall buildings and campus buildings.

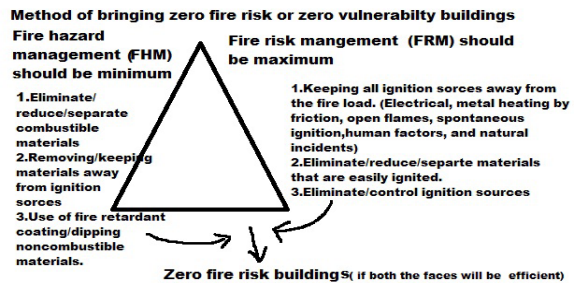
3. PRACTICAL SOLUTION;

3.1 FIRE HAZARD and FIRE RISK MANAGEMENT SYSTEM/METHOD

Fire triangle: The below triangle explains the basic principle of fire occurrence, one face of the triangle having ignition, the second face of the triangle is having fuel and the third face of the triangle is having oxygen when all the three faces are comes in to contact the fire is occurring. This is the basic principle of the fire. The triangle is known as fire triangle.



Fire prevention triangle: The fire hazard and fire risk management triangle is working in reversal direction of fire triangle. Due to its reversal working it is called fire prevention triangle. It prevent the direct contact of fuel and the ignition by wise management.



By Keeping the minimization of fire load in one side of the triangle and maximizing the fire risk management on another side of the triangle. Therefore the third face of the triangle bringing the building under safer fire zone. The possibility of fire vulnerability is less inside and outside of the. This type of maintaining building is called zero fire risk building.

3.2 Materials management method:

The selection and use of furniture and utensils materials which are used in the buildings should be in any one of the following treatment method. This will avoid the quick fire spread in the buildings.

Impregnation treatment method: Mon Ammoniumphosphate can be applied on each layer of the combustible materials while in manufacturing.

Surface treatment method: By Paints applications, non combustible material's skim coating in the form of plastering, spraying and trowel led coating will avoid the quick fire spread.

Use of composite materials method: The mixture of organic and inorganic materials will become non-combustible material, such materials can be used..

3.3 Practical Trainings Solution: (for All Type of Buildings)

The practical training should become mandatory for all type of building's occupants. The main objective of training should be "the well organized behaviour of the occupants to react with the fire and to tackle the emergency situations".

The practical training key elements are: knowing the activities going in side of the building on every day, the plan of the building, maintaining escape routes, Possibilities of fire, ignition sources, fire load, fire type, Response procedure, call numbers, contact persons, communication system and evacuation practice for emergency. They must thoroughly be knowledge and trained to protect lives and property against fire without danger.

3.4 The following Theoretical and practical knowledge required for School children for future fire safety:

The students must know the knowledge of the word SAFETY. The meaning of accidents Following safety rules and procedure, knowledge of fire, handling inflammables, gas cylinders, using of electricity, meaning of short circuits, handling of crackers during festive, using of electrical appliances, machines, other devices, at the time of fire occurs the way to contact fire professionals, contact persons, call numbers, nearest fire station, etc.

The knowledge of behavior when fire catches on body: The following Training and the knowledge has to be given to the students through the fire professionals. When fire catches on the body, Stop running to decrease oxygen, drop down to

the ground, close eye and face and roll on the ground. These basic behaviors will save children from serious injuries.

The knowledge of First aid procedure and training: The following training and the knowledge has to be given to the students through the medical professionals. Remove the burnt clothes immediately, run the cold water over the burnt areas, gentle cleaning, soft touch up, make it dry, using of sterile bandage to cover the burns, admit the patient to the hospital immediately, nearest hospitals numbers, ambulance numbers. The above said theoretical and the practical training to the school children to be incorporated in the curriculum of syllabus at the school level itself.

3.5 INTEGRATED ADMINISTRATIVE SAFETY METHOD IN BUILDINGS. (IAM)

This is one of the building management method or system. The following are the recommendation to be implemented to ensure Resilient and Reliable Environment for a safety life in buildings. This method is applicable for all buildings but most suitable for high rise, tall building and campus buildings.

Planning the new fire safety system and it is integrated with the existing methods and ensure its compatibility, Ensure periodical, proper care and maintenance, working condition of fire and life safety systems provided in the premises Ensure existing exits facility and its sufficiency for current requirements if the capacity is increasing Ensure and establish effective auto/manual integrated mechanism between passive and active systems provided in the premises.

Providing arrangements /resources for supply of extinguishing materials in case of major need Updating and adopting specialist advice, accepting the feedback from the society and should provide performance based fire safety compliance of the building.

Preparing and conducting training, on/off site emergency mock drill. Provision and maintenance of personal protective equipment.

Create provisions to ensure shared wisdom to Promote new ideas involvement in developing fire safety awareness and risk management activities of the users

Applying CCTV Surveillance system to ensure 360 degree safety in day and night.

4. CONCLUSION.

The existing fire safety methods used for extinguish the fire as early as possible. The recommendation of new systems and the management will be useful for before occurring the fire. Along with these methods, if we follow the functional performance procedure, the mitigation strategies procedure, proper housekeeping procedure, Maintenance of the building procedure, and behaviour of the people with safety conscious, will definitely assure the absolute fire safety in the buildings in future.

REFERENCE

- [1] National building code of India 1983 & 2005 | [2] National Fire Protection Association code book, | [3] Chennai Metropolitan Development Control Authority Regulation. | [4] Tamil Nadu Fire & Rescue Services department Rules and regulations | [5] V.K Jain, Fire safety in buildings. | [6] National fire safety council guide. | [7] Relevant Indian government Acts and rules | [8] Fire technology text book, fire safety engineering curriculum. | [9] Press reports, | [10] Fire safety research institute-journals |