

MONOGRAPH ON FIRE HAZARD



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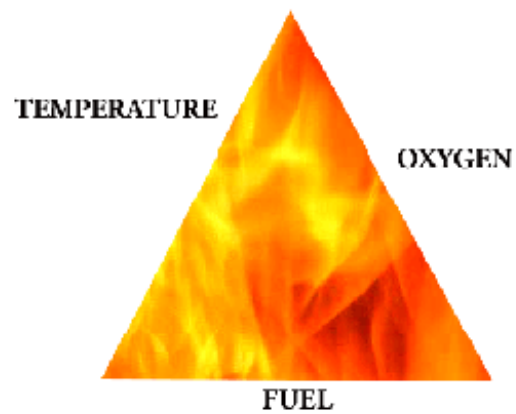
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FIRE:

Fire was discovered by ancient man during the Lower Paleolithic period. Since then Fire has been an important part of human settlements, cultures and religions, from pre-history to modern day, and was vital for the development of civilization. It was commonly associated with the qualities of energy, assertiveness, and passion. The word *agni* is Sanskrit for "fire", and has three forms: fire, lightning and the sun.



FIRE HAZARD:

A **fire hazard** is any situation in which there is a greater than normal risk of harm to people or property due to fire. Fire hazards include things which, in the event of fire, pose a hazard to people, such as materials that produce toxic fumes when heated or objects that block fire exits.

Fire hazards can take the form of ways that fires can easily start, such as a blocked cooling vent, or overloaded electrical system, ways fires can spread rapidly, such as an insufficiently protected fuel store or areas with high oxygen concentrations.

HISTORY OF FIRE SERVICES:

The following are some of the land marks of development in the history of Fire Services

- 321 BC - In Kautilya's Arthashastra there were chapters about Fire Preventive Rules
- 27-14 BC - Fire Station concept of Augustus Caesar in Roman Empire.
- 1027 A.D - Fire Preventive Codes by King William-I
- 1666 A.D - Great London Fire.
- Modern Fire and Rescue Services.

CLASSIFICATION OF FIRE: (According to ISI - 2190/1979)

The classification of fire is done according to the material by which the fire is caused.

1. Class 'A' Fires:

These are fires involving solid materials, normally of carbon compounds in which combustion generally occurs with the formation of glowing embers. These types of fires are most common. Example - Wood, rags, paper, plastic, coal etc.

2. Class 'B' Fires:

These fires involve flammable liquids or liquefiable solids. That is, fires occurring in vapor-air mixture over the surface of flammable liquids, such as gasoline, oils, paints, thinners, ghee, fats, petroleum products etc.

3. Class 'C' Fires:

These are fires involving liquefiable gases like Propane, Butane, LPG, H₂, Acetalene etc.

4. Class 'D' Fires :

These are fires that occur in combustible metals such as magnesium, titanium, sodium etc. These burning metals react with water and water containing agent.

CURRENT STATUS AND TRENDS OF FIRE INCIDENTS:

Fire incidents can be classified according to the material that causes fire, the intensity of damage, the type of buildings that were damaged etc. The current trend of fire incidents in Metro cities shows an increasing in number of fire incidents. The following are some of the current status of fire incidents in some of the metro cities in India.

1) **DELHI:**

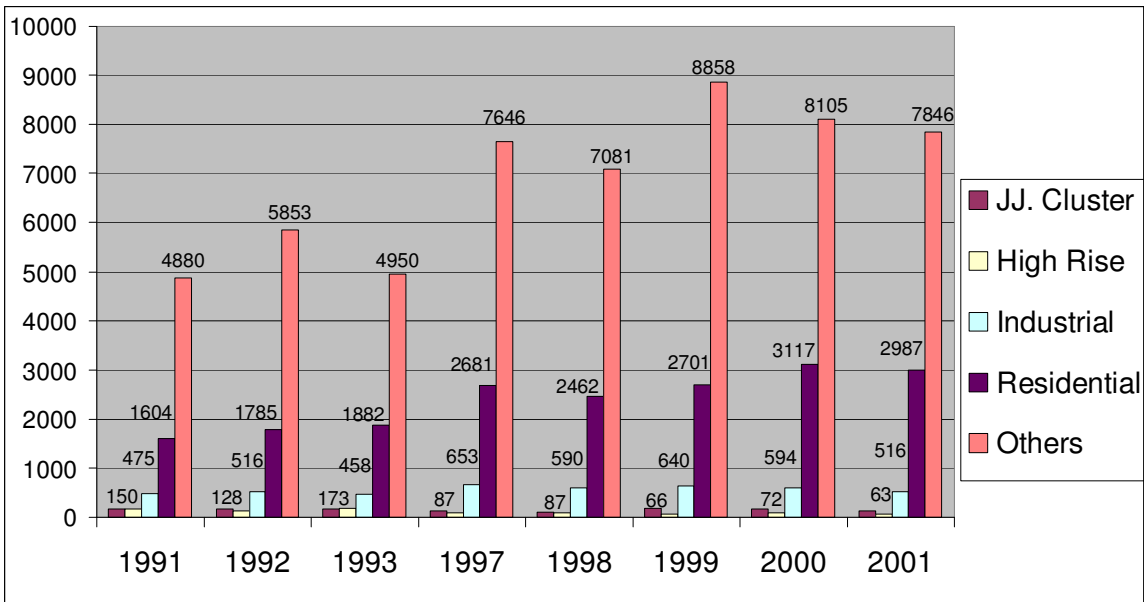
According to Delhi Fire Service statistics, Delhi had more than **75,000** fire incidents during **1995-96 to 1999-2000**, resulting in more than 1825 deaths, injuries to more than 7,600 persons and loss of property valuing more than Rupees 176 crores. The Delhi state has a special Act for Fire prevention called as “**Delhi Fire Prevention and Fire Safety Act, 1986**”



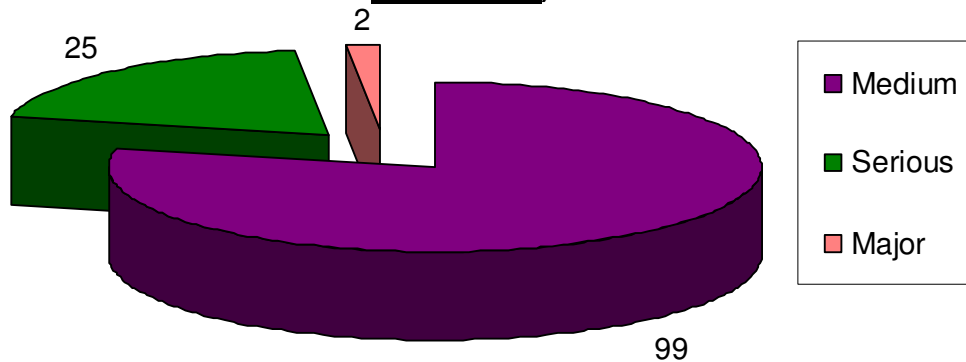
Some of the major fire incidents in Delhi are:

- Lal Kuan fire
- Gandhi Market, Sadar bazaar fire, 1990.
- Siddartha Hotel, Jan 1986.
- Uphaar Cinema, June 1997

TRENDS IN FIRE INCIDENTS IN DELHI ('91 – '01):

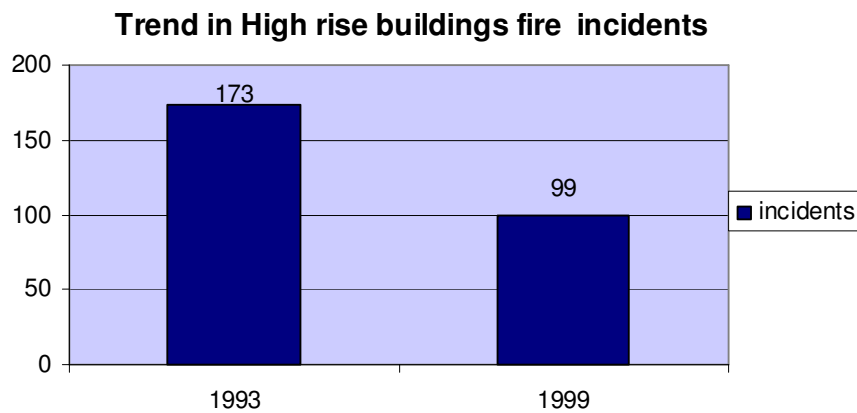


No. of fire incidents in Delhi (1995 - 2000)

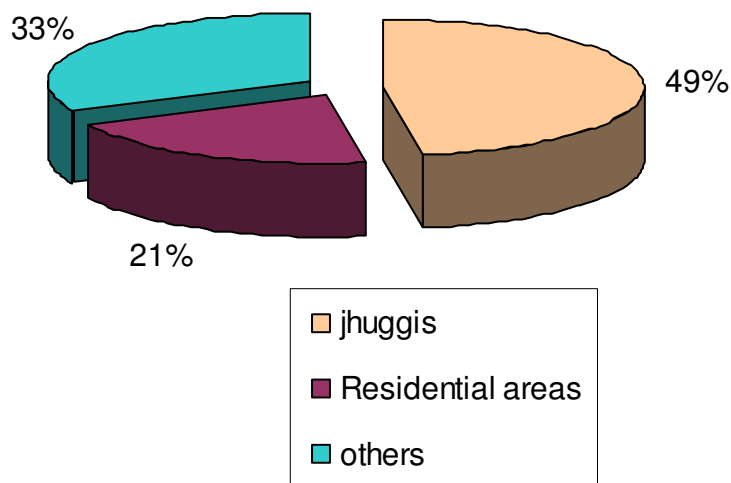


The only redeeming feature in this is the **declining trend** in high - rise building fires - down from a high of 173 in 1993 to only 66 in 1999, achieved because of the pursuit by Delhi Fire Services of enforcement of the minimum fire safety standards in such buildings.

The number of high-rise buildings not complying with such standards has now come down to about 70 only from 220 earlier.



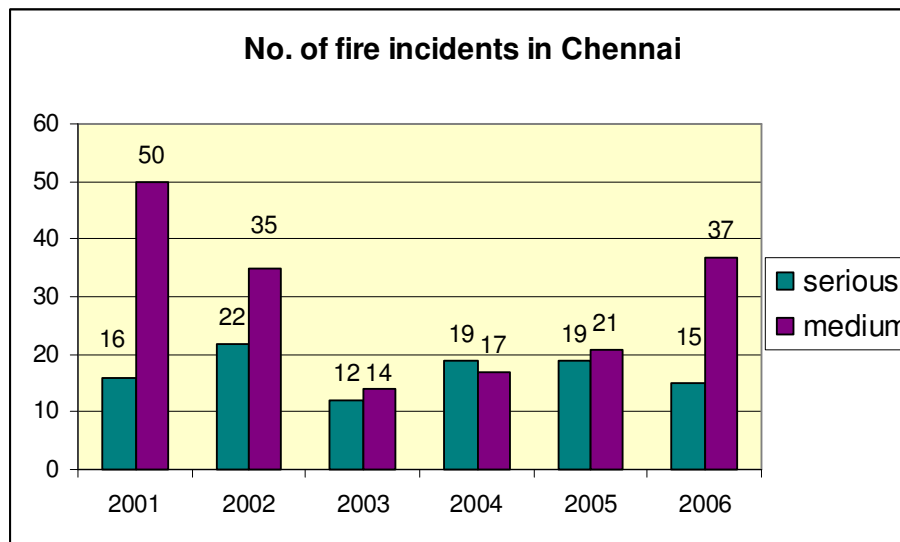
PERCENTILE INCREASE OF FIRE INCIDENTS IN DELHI



2) CHENNAI:

According to Tamilnadu Fire Service statistics, Chennai had more than **8950** fire incidents during the last five years (**2001 to 2006**), resulting in more than **31** deaths, loss of property valuing more than Rupees 10.39 crores.





The Statistics in the fire incidents in Chennai shows a declining Trend in the number of medium sized fire incidents in the city in the period 2001 – 2005 but increased during 2006. Whereas the number of serious fire incidents remain more or less same throughout the period. The following are some of the major fire incidents that happened in Chennai:

- LIC Building Fire, Chennai (11th July 1975)
- Fire In Spencer Buildings (13th February 1981)
- Moore Market, Chennai (30th May, 1985)
- Fire In Air France Aircraft (5th March, 1999)
- Fire In General Post Office, Chennai (23 October 2000)

This are some of the Fire incidents that has happened in the High Rise buildings in Chennai

- LIC Building, Chennai
- National Insurance Building, Chennai
- Telephone Exchange, Chennai

Fire Rules and Regulations:

All metro cities in India has fire regulations and norms and it is mandatory to get No objection Certificate (NOC) for buildings and Delhi has the most comprehensive fire regulations of all cities . The following are some of the regulations under the “**Delhi Fire Prevention and Fire Safety Act, 1986**” to prevent and minimize the effect of fire Hazard. The following table gives the details of the minimum fire safety requirements for various types of buildings.

Fire Safety requirements for various Building type& heights

Type of Building occupancy	Requirements
a) Apartment building below 15 m height irrespective of floor area	Nil
b) Apartment building exceeding 15 m in height	Wet risers and (or) Down comers.
c) Non-Apartment building 15 m and above in height irrespective of floor area	Wet risers and (or) Down comers.
d) All basements, sub - basements having special risks like storage of hazardous explosive material in a building 15m and above	High pressure water spray or foam

This table discusses how many number of persons (occupants) can occupy a particular area in a particular type of building according to the fire safety norms.

Occupancy Load for Various Types Of Buildings

Sl.No	Type of building (Group Occupancy)	Occupancy load Gross area* in sq.m/person
1	Residential	12.5
2	Educational	4
3	Institutional	15**
4	Assembly	
	a) With fixed or loose seats and dance floors	0.6***
	b) Without seating facilities including dining rooms	1.5***
5	Mercantile:	
	a) Street floor and sales basement	3
	b) Upper sale floors	6
6	Business and Industrial	10
7	Storage	30
8	Hazardous	10

* The gross area shall mean plinth area or covered area.

** Occupant load in dormitory portions of homes for the aged, orphanages, insane asylums etc. where sleeping accommodation is provided, shall be calculated by not less than 75-sqm gross area/person.

*** The gross area shall include, in addition to the main assembly room or space, any occupied connection open or space in the same storey or in the storey above or below, where entrance is common to such rooms and spaced and they are available for use by the occupants of the assembly place. No deductions shall be made in the gross area for corridors, closets or other sub-divisions; one area shall include all space serving the particular assembly occupancy.

Fire regulations for restaurants:

All restaurants with seating capacity of 50 persons and more have to follow the fire safety measures irrespective of the building height. The existing restaurants should also have minimum fire safety devices as specified by the Delhi fire Services Department. Some of the requirements are as follows:

- An Underground Water tank of 50000 litres capacity.
- A Terrace Water Tank of 5000 litres capacity for hose reel & 10000 litres capacity if sprinkler is not provided.
- If the covered area is more than 1500 sq.m or seating capacity is more than 1000 persons there should be a Sprinkler system.

Fire regulations for Educational Institutions:

All Educational Institutions have to follow the fire safety measures irrespective of the building height. The existing Institutions should also have minimum fire safety devices as specified by the Delhi fire Services Department. Some of the requirements are as follows:

For Ground floor:

- One overhead water storage tank of 5000 litres shall be provided exclusively for feeding water to the sprinkler system

For Ground + two floors:

- An overhead water tank having 2500 litres capacity (5000litres capacity in case of sprinkler system and /or down comer system) shall be provided exclusively for fire fighting system.
- If the total covered area is more than 5000 sq.m and upto 10000 sq.m, an additional underground water storage tank of 25000 litres capacity shall be provided. If the total covered area exceeds 10000 sq.m, the capacity shall be 50000 litres.

Fire Precautions in buildings:

The following are some of the precautions that have to be followed to prevent Fire hazard, in High rise, Industries, Temporary Structures and in any Buildings:

- Do not allow encroachments or storages in the courtyards of the building.
- Do not allow storages or obstructions in the common corridors, staircases and electric Meter Rooms.
- Do not allow the Fire doors of the staircases to be kept open.
- In case of fire, do not use LIFTS for escape.
- Do not use the basement for any purpose other than permitted purpose.
- Seal the electrical ducts at each floor slab level.
- The A.C ducts should not pass through one floor to another, sectionalise them.
- Never paint or coat fire detectors or sprinkler heads.
- Do not decorate walls and ceilings of common corridors with combustible material such as wooden paneling etc.
- Do not allow Fire fighting tanks to be misused or remain empty.
- Do not 'switch off' Fire/Smoke Detection System.
- Do not carry out additions and alteration in the building.
- Acquaint yourself with the layout of the escape routes, staircases, refuge areas and the location of fire alarms.
- Always keep the doors of fire staircases closed.
- All the fire protection installations should be kept in a good state
- Ground all the lifts, including FIRE LIFT, in case of a fire.

Fire Precautions in High Rise Buildings

- All receptacles for waste should be emptied at regular intervals.
- Faulty electrical appliances should be repaired/ replaced immediately.
- Switches and fuses should conform to correct rating of circuit.
- Welding /Cutting jobs should be carried out under strict supervision.
- Keep smoke/Fire Check doors closed.
- Keep means of escape clear of obstructions.
- Fire Rescue drills should be carried out at regular intervals.
- Impart elementary fire fighting training to occupants.
- Don't plug too many electrical appliances in one socket.
- Don't paint fire detector/sprinkler heads.



Fire Precautions for Temporary Structures/ Pandals:

- The height of the ceiling of the pandal should not be less than 3 metres.
- The Margins of at least 3 metres should be kept on all sides-away from any preexisting walls or buildings.
- Structure should be erected reasonably away from railway lines, electric substations, live electric line, furnaces or other hazardous places and a minimum distance of **15 metres** should be maintained.
- Exits on all sides of the pandal shall be kept sufficiently wide (minimum 1.5 metres).
- Kitchen must be segregated by providing separation walls of noncombustible material (G.I. Sheets) from the remaining area of the temporary structure.

Fire Precautions in Industries:

- Store flammable liquids gases, solvents, chemicals in stable racks, correctly labeled.
- Keep chemicals in cool and dry place away from heat.
- Where hazardous chemicals are used/ stored, ensure adequate ventilation and prohibit smoking.
- Use fuses and circuit breakers of correct capacity.
- Before welding operation, all traces of flammable material must be removed to a safe distance.
- Welding/Hot work should be carried out under proper fire watch.
- Keep all machinery clean and lubricate it to avoid friction and overheating.
- Regular fire drills should be carried out.
- Don't place obstruction in means of escape.
- Don't use damaged cords and avoid temporary connections.

IMPACTS OF FIRE:

The impacts can be divided into the categories below based on the mechanism that caused the impact and the spatial and temporal relationship between burning and impact:

- **Direct Impact:**

These are impacts caused by immediate damage caused by the flames such as injuring/causing death to humans, destruction of property etc.

- **Indirect Impact:**

These are impacts resulting from the fire incident indirectly. It causes income loss and employment loss for so many people. The Smoke and haze produced because of fire causes acute human ailments. The other indirect impacts include disruption in transport, business, and tourism, contributes to the production of ozone, acid rain, and greenhouse gases.



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