

FIRE DOOR AWARENESS AMONG THE STAKE HOLDERS OF CONSTRUCTION INDUSTRY

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Abstract: *The spread of fire can be restricted by sub-dividing buildings into a number of discrete compartments. These fire compartments are separated from one another by compartment walls and compartment floors made of a fire-resisting construction which hinders the spread of fire. Fire door shutter, fire door frame and builder hardware are critical element in the fulfilment of buildings fire safety. Fire door is part of the passive design of a structure. This paper concluded that stake holders are aware of fire doors and manufacturing guidelines, like time temperature curve BS 476, builder's hardware, certifying agencies in India, maintenance of doors and alternate infill materials, but owner of the building does not have in depth knowledge of the fire doors.*

Keywords: Compartmentalization, Passive design, Fire Doors, fire resistance

1. Introduction:

The habitable buildings i.e. residential or commercial or office spaces are designed keeping the fire safety of occupants in case of fire engulfs the living space. The safety against the fire shall be treated in the design of a structure either in passive or active mode or both. The spread of fire can be restricted by sub-dividing buildings into a number of discrete compartments. These fire compartments are separated from one another by compartment walls and compartment floors made of a fire-resisting construction which hinders the spread of fire. It is observed from past fire hazard that the lives lost due to smoke and stampede. Hence, to prevent fire spread in horizontal directions, the horizontal openings (i.e. horizontal circulation) shall be accommodated with a fire rated door and door set, so that, occupants shall be safely evacuated without exposing them to the fire spread, smoke, and heat. The elements of appropriated fire rated door shall be tightness and the fire integrity, fire insulation and smoke control.

2. Fire:

Fire shall be explained as exothermic chemical process of combustion, releasing heat, light etc., Fire felt hot due to molecular oxygen is enhancing stronger bond from weaker bond and while combustion the carbon dioxide and water releases energy, it is estimated approximately as 418 KJ per 32 g of oxygen. The visible fire flames shall be observed after a ignition point and the flame consists of carbon dioxide, water vapour, oxygen and nitrogen. The colour and intensity of flame depends on combustible substance and existing impurities in external environment.

3. Fire compartmentation:

Compartmentation will prevents the immediate spread of fire which could trap the occupants of a building, reduces the chance of fires growing and creating a danger to occupants, fire and rescue services, and people in the vicinity of the building and it limits the damage to a building and its contents. The area division in to compartmentation will depends on usage of building, fire load in the building and height of the building. Passive fire protection measures, such as fire stops, fire walls, and fire doors, are tested to determine the fire resistance rating of the final assembly, usually expressed in terms of hours of fire resistance (e.g., 1/3, 3/4, 1, 1 1/2, 2, 3, 4 hour).

4. Passive fire protection (PFP):

PFP is a group of systems within systems and it is included in the construction of structure and it responds as and when fire engulfs the building members. The PFP has been classified in to intumescent fire protection and vermiculite fire protection. To protect the structural steel members a thick layer of paint shall be applied and it shall be called as Intumescent fire proofing, but shall be applied immediately over the final coat finishing over the steel members, but if a very thick layer vermiculite (cementitious) materials, applied on to the structural member shall be treated as vermiculite fire protection. It forms part of a fire-resistance rated wall or floor and this wall or floor forms part of a fire compartment, which forms an integral part of the overall fire safety plan of the building, which, as a whole, can also be seen as a system.

- i. Fire-resistance rated walls
- ii. Firewalls not only have a rating, they are also designed to sub-divide buildings such that if collapse occurs on one side, this will not affect the other side. They can also be used to eliminate the need for sprinklers, as a trade-off.
- iii. Fire-resistance glass using multi-layer intumescent interlayer technology to meet ASTM-E119 test standards. The glass is optically clear, and can be used in 60 minute and 120 minute fire resistance rated assemblies. The International Building Codes (IBC) allows this glass to be installed as a fire-rated wall.
- iv. Fire-resistance rated floors
- v. occupancy separations (barriers designated as occupancy separations are intended to segregate parts of buildings, where different uses are on each side; For instance, apartments on one side and stores on the other side of the occupancy separation).
- vi. Closures (fire dampers) Sometimes firestops are treated in building codes identically to closures. Canada de-rates closures, where, for instance a 2 hour closure is acceptable for use in a 3 hour fire separation, so long as the fire separation is not an occupancy separation or firewall. The lowered rating is then referred to as a fire protection rating, both for firestops, unless they contain plastic pipes and regular closures.
- vii. Grease ducts (These refer to ducts that lead from commercial cooking equipment such as ranges, deep fryers and double-decker and conveyor equipped pizza ovens to grease duct fans. In North America, grease ducts are made of minimum 16 gauge (1.6 mm) sheet metal, all welded, and certified openings for cleaning, whereby the ducting is either inherently manufactured to have a specific fire-resistance rating, OR it is ordinary 16 gauge ductwork with an exterior layer of purpose-made and certified fireproofing. Either way, North American grease ducts must comply with NFPA96 requirements.)
- viii. Cable coating (application of fire-retardants, which are either endothermic or intumescent, to reduce flame spread and smoke development of combustible cable-jacketing)
- ix. Spray fireproofing (application of intumescent or endothermic paints, or fibrous or cementitious plasters to keep substrates such as structural steel, electrical or mechanical services, valves, liquefied petroleum gas (LPG) vessels, vessel skirts, bulkheads or decks below either 140 °C for electrical items or ca. 500 °C for structural steel elements to maintain operability of the item to be protected)
 - Fireproofing cladding (boards used for the same purpose and in the same applications as spray fireproofing) materials for such cladding include perlite, vermiculite, calcium silicate, gypsum, intumescent epoxy, DuraSteel (cellulose-fibre reinforced concrete and punched sheet-metal bonded composite panels)
 - Micro Therm Enclosures (boxes or wraps made of fireproofing materials, including fire resistive wraps and tapes to protect speciality valves and other items deemed to require protection against fire and heat—an analogy for this would be a safe) or the provision of circuit integrity measures to keep electrical cables operational during an accidental fire.

5. Terminology:

5.1 Fire door: A door or shutter provided for the passage of persons, air or things which, together with its frame and fixture as installed in a building, is intended, when closed, to resist the passage of fire and/or gaseous products of combustion and is capable of meeting specified performance criteria to those ends. The fire doors may be insulated or un-insulated. Door sets have two important functions in a fire, when closed they form a barrier to fire spread and when open they provide a means of escape.

5.2 Fire fighting Shaft (Fire Tower) — An enclosed shaft having protected area of 120 min fire resistance rating comprising protected lobby, staircase and fireman's lift, connected directly to exit discharge or through exit passageway with 120 min fire resistant wall at the level of exit discharge to exit discharge. The fire fighting shaft shall be equipped with 120 min fire doors.

5.3 Fire Load: — Calorific energy, of the whole contents contained in a space, including the facings of the walls, partitions, floors and ceilings.

5.4 Fire Load Density: — Fire load divided by floor area.

5.5 Fire Resistance: — Fire resistance is a property of an element of building construction and is the measure of its ability to satisfy for a stated period, some or all of the following criteria:

5.5.1 Load bearing capacity (Stability) (R) — The ability of a load bearing element to withstand fire exposure without any loss of structural stability.

5.5.2 Integrity (E) — Resistance to penetration of flame and hot gases.

5.5.3 Insulation (I) — Resistance to temperature rise on the unexposed face up to a maximum of 180°C at any single point and average temperature of 140°C.

5.5.4 Fire Resistance Rating— The time that a material or construction will withstand the standard fire exposure as determined by fire test done in accordance with the standard methods of fire tests of materials/ structures as per the accepted standard

5.6 Fire Exit Hardware -A door latching assembly incorporating an actuating member or panic bar that releases the latch bolt upon the application of a force in the direction of egress travel, provided on exits.

5.7 Horizontal Exit — A defend in place or a staging arrangement, providing safety from fire and smoke originating from the area of incidence, by allowing alternative egress from a compartment to an area of refuge or another compartment at or near the same level. This also includes such egress from a compartment to an adjoining building. A horizontal exit shall be through a fire door of 120 min rating in a fire resistant wall. Horizontal exit require separation with the refuge area or adjoining compartment through 120 min fire barrier. The adjoining compartment of the horizontal exit should allow unlocked and ease of egress and exits for the occupants using defend in place strategy.

6. Objective of the study: The objective this study is understand the awarness of usage of fire doors by building owners, architects, consultants and fire door manufacturers in construction industry in Hyderabad.

7. Need for study: Fire hazards are inevitable because of overloading or mishandling of the electric circuits in a any habitual building or ignition of fire due to any other reason. In the interest of saving human lives during the fire hazard it is advisable to have compartmentalization with fire doors which should be part of passive design while planning the building/commercial building layout. It serves occupants in two aspects, firstly it will stop the fire spread when the fire doors are in closed position, secondly, it allows the human lives escape out of the fire location when fire doors are open. To withstand the increasing temperature wooden doors may required to be replaced with a better material/s.

8. Study Design: The study design refers to the overall strategy. It will be a blue print for collection, measurement and data analysis. The present study is of descriptive in nature.

9. Data collection: Primary data is collected through self administered structured questionnaires from stakeholders of construction industry.

10. Sampling method: The sample will be selected using non-probability - convenience sampling method.

11. Summary of Responses : The summary of collected information about awareness of fire doors, fire rated door and hardware is depicted in Fig.1, fire door maintenance information is depicted in Fig.2 and information about temperature curve BS 476 in Fig.3

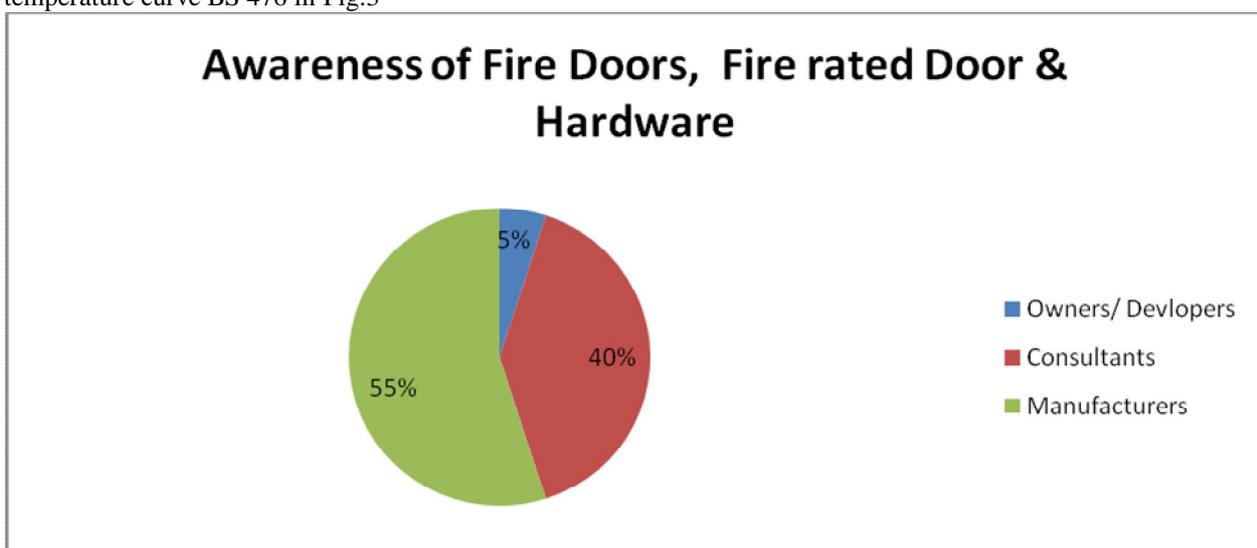


Fig.1: Awareness of Fire Doors, Fire rated Door & Hardware

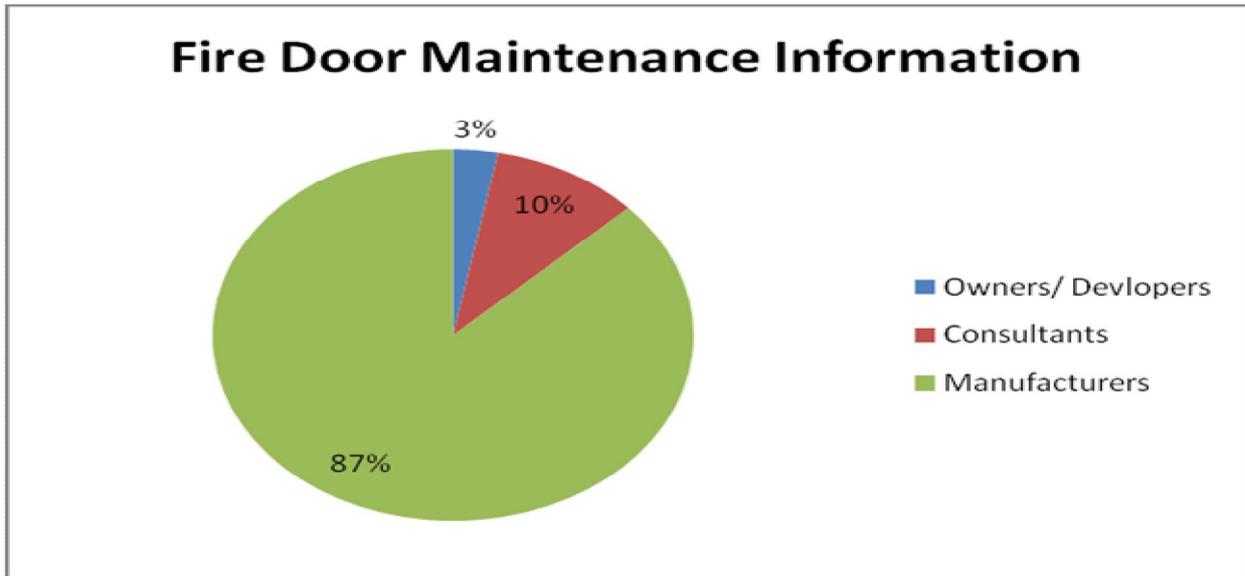


Fig.2: Fire Door Maintenance Information

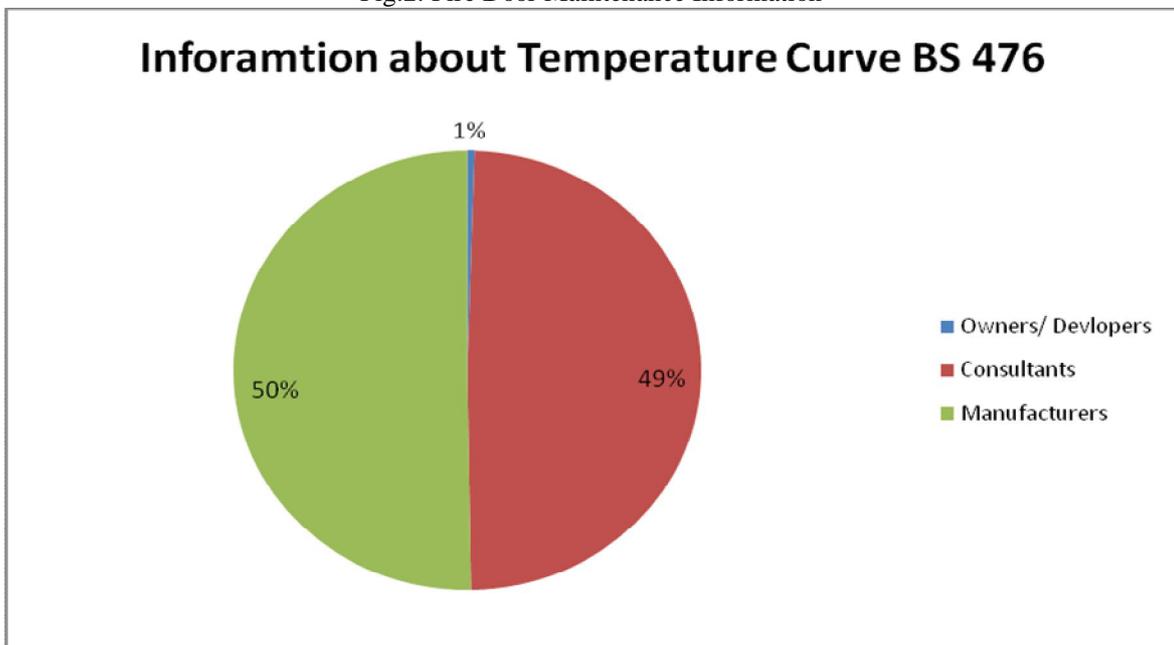


Fig.3: Information about Temperature curve BS 476

12. Hypotheses: The following hypotheses have been formulated based on questionnaire

12.1 Hypotheses-I:

H₀: Owners of the building have no information regarding fire doors

H_a: Owners of the building have information regarding fire doors.

12.2 Hypotheses-II:

H₀: Owners of the building have no information regarding fire rating of doors.

H_a: Owners of the building have information regarding fire rating of doors.

12.3 Hypotheses-III:

H₀: Owners of the building have no information regarding maintenance of fire doors.

H_a: Owners of the building have information regarding maintenance of fire doors.

12.4 Hypotheses-IV:

H₀: Manufacturer do not practice time temperature curve BS 476 guidelines in manufacturing the fire doors.

H_a: Manufacturer practice time temperature curve BS 476 guidelines in manufacturing the fire doors.

12.5 Hypotheses-V:

H₀: Manufacturer do not comply builder's hardware with the door fire rating.

H_a: Manufacturer comply builder's hardware with the door fire rating.

12.6 Hypotheses-VI:

H₀: There is no certifying body for fire doors in India.

H_a: There is a certifying body for fire doors in India.

12.7 Hypotheses-VII

H₀: Fire doors require no maintenance.

H_a: Fire doors require maintenance.

12.8 Hypotheses-VIII:

H₀: Fire doors are made up hollow section with no fill.

H_a: Fire doors are made up hollow section by material filling.

13. Analysis and inference: From the analysis (i.e. SPSS package) of the data the following points are inferred:

- a) Hypotheses-I: alternate hypotheses has been accepted by rejecting the null hypotheses.
- b) Hypotheses-II: null hypotheses has been accepted by rejecting the alternate hypotheses.
- c) Hypotheses-III: null hypotheses has been accepted by rejecting the alternate hypotheses.
- d) Hypotheses-IV: alternate hypotheses has been accepted by rejecting the null hypotheses.
- e) Hypotheses-V: alternate hypotheses has been accepted by rejecting the null hypotheses.
- f) Hypotheses-VI: alternate hypotheses has been accepted by rejecting the null hypotheses.
- g) Hypotheses-VII: alternate hypotheses has been accepted by rejecting the null hypotheses.
- h) Hypotheses-VIII: alternate hypotheses has been accepted by rejecting the null hypotheses.

14. Conclusion:

The following points have been concluded from the study and they follow as:

- a) Building owners have information about fire doors but, do not have in depth knowledge about the fire rating of doors, builders hardware, maintenance of doors etc.,
- b) Consultants well equipped about the fire door requirements, compartmentalization of space, door opening importance and fire door rating. Architects incorporates compartments in the building plan, fire safety engineers recommend and specify the fire rated doors according the design demand.
- c) Fire door manufacturers adhere to time temperature curve BS 476 guidelines, but they do manufacture according to buyer's fire door specification.

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