

## Fire Evacuation- High-risebuildings

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### ABSTRACT

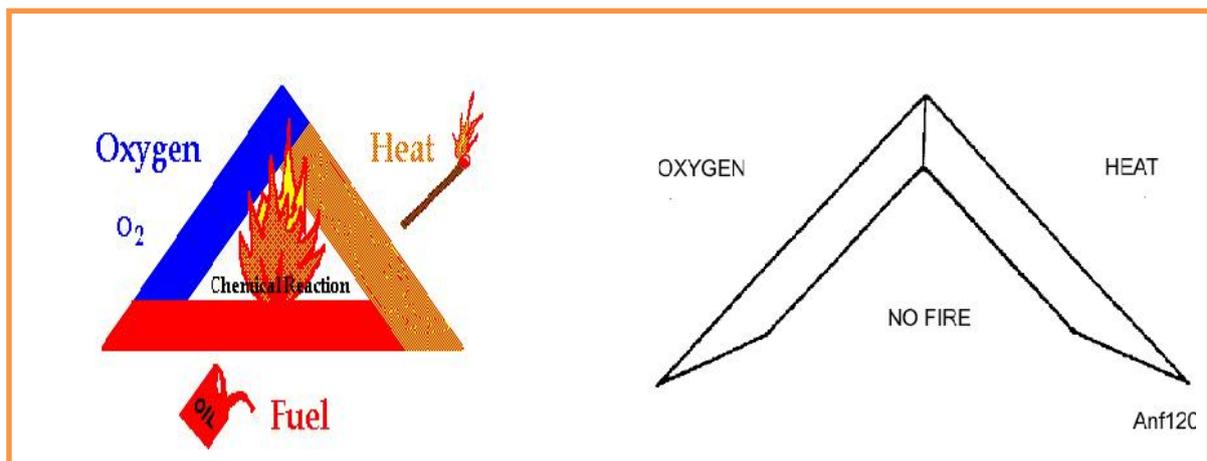
*The Paper aims to study of importance of fire fighting in a multistorie building. More and more multistory Buildings are built nationwide, the more challenging job is for the fire fighters. Multistory building Occupancies include residential, commercial businesses, health-care facilities, assisted living centers, hotels, Motels etc.*

*Through the centuries there has been such an intimate connection of fire with the cultural growth of humanity. Logically we assume there was once a time when man had no fire, but soon he acquired the natural sources of fire and made use of it. Fire can be natural as well as manmade. Much later artificial means of creating fire were invented.Fires -needed watching, not only to keep them from going out, but from spreading, or theft, so a fire-keeper was delegated to the work, thus starting a social organization.*

### INTRODUCTION

#### A. FIRE

Fire is rapid, self-sustaining oxidation process accompanied by the evolution of heat and light in varying intensities. The starting of a fire involves three elements. These three elements may be compared to the three legs of a triangle (Refer Fig.1) and fire cannot occur until all three are brought together.



**Fig.1: FIRE TRIANGLE**

No building material is perfectly fire proof. Every building contains some materials (such as furniture, clothing, eatables etc.), which can either easily catch fire or which are vulnerable. The technical interpretation of *fire safety* of building is to convey the *fire resistance of buildings in terms of hours* when subjected to fire of known intensity. It should have structural time interval so that adequate protection to the occupants is afforded.

## A.1 CAUSES OF FIRE:

Most fire is caused by carelessness. Some common instances are:-

- Careless discarding of lighted ends of cigarettes, cigars, matches and tobacco.
- Smoking in **unauthorized** places.
- Indifferent maintenance of machinery including overloading and under or over lubricating of bearings.
- General indifference to cleanliness.
- Incorrect storage materials.
- Faulty workmanship and inattention to electrical installations.
- Un-approved equipment and layout.
- Inattention of persons concerned with inspection and patrol of the premises under their jurisdiction
- Inattention of fire safety regulation.

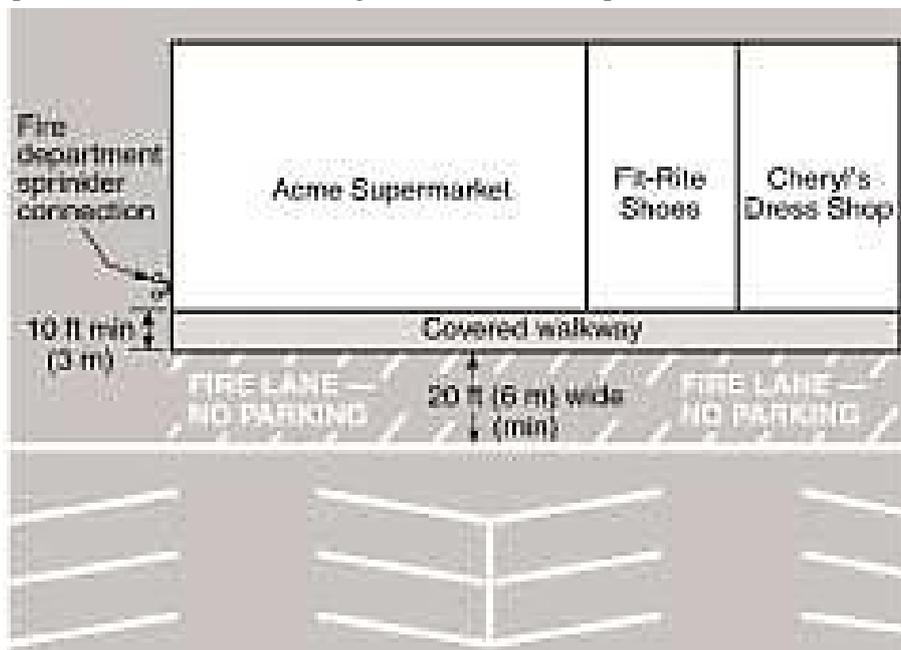
## A.2 BUILDING SITING AND DESIGN:

The faster the fire service can respond, enter, locate the incident, and safely operate in a building, the sooner they can mitigate an incident in a safe manner for themselves as well as occupants.

### A.2a FIRE APPARATUS ACCESS

Properly positioning fire apparatus can be critical at a fire scene. Minimum required width of the access is 20ft. Good aerial apparatus access at an apartment fire.

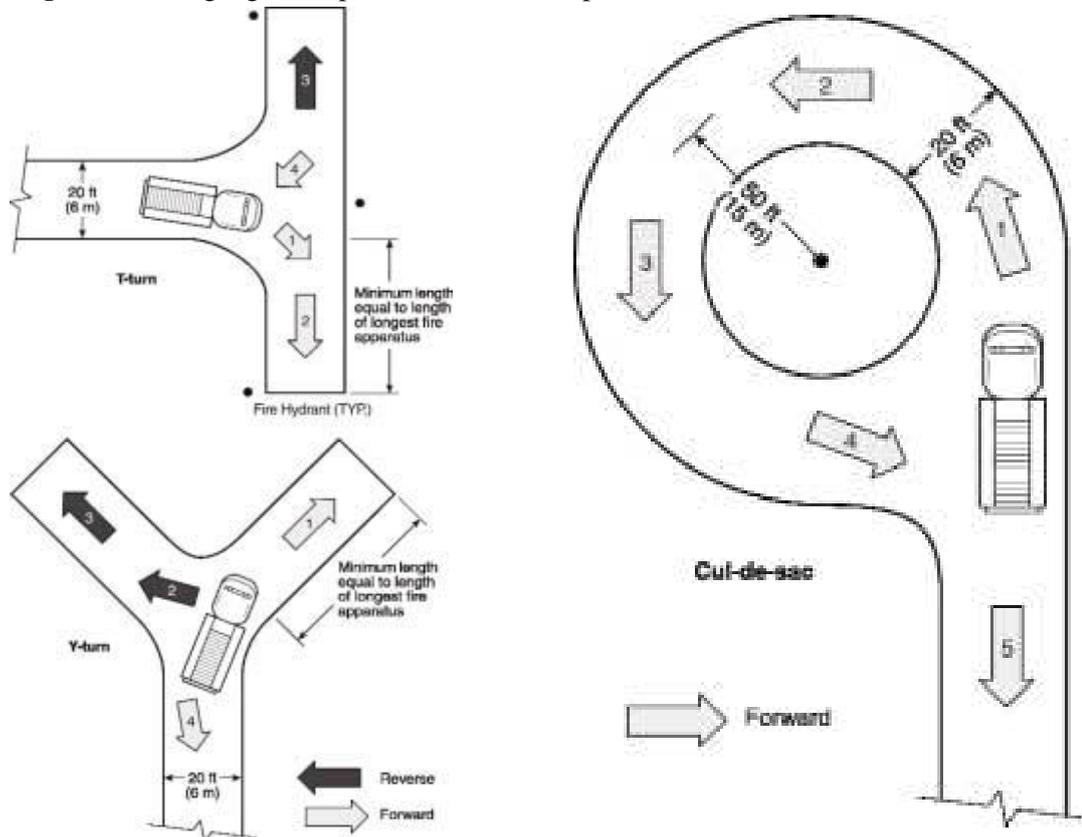
This fire lane (Refer Fig.2&2a) is wide enough to allow passing even when aerial outriggers are extended, and it is located a proper distance from the building to facilitate aerial operations.



**Fig.2: FIRE LANE ACCESS**

- **Clear height:** minimum 13 feet 6 inches; higher where subject to accumulations of snow and ice.
- **Obstructions:** avoid overhead wires and other obstructions.
- **Turn radius:** minimum 25 feet inside and 50 feet outside.
- **Curb cut:** if provided, extend 2 feet beyond on each side of intersecting fire lane.
- **Gate size:** at least 2 feet wider than fire lanes.

- **Gate location:** at least 30 feet from public right-of-way.
- **Gate swing:** away from direction of fire apparatus travel.
- **Speed Control Measures:** Speed bumps or humps can impact fire apparatus access.
- **Marking:** Fire lane signage is important, both for the public and enforcement officials



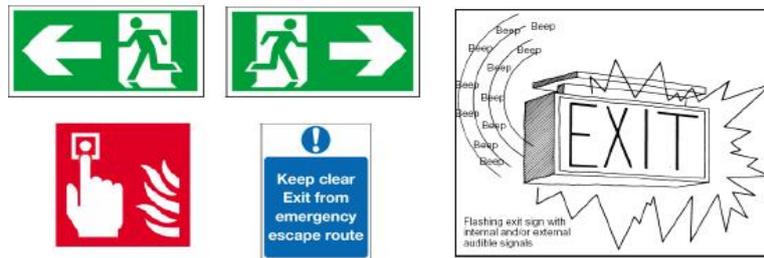
**Fig.2a: FIRE LANE ACCESS**

### A.2b FIRE HYDRANTS

- **Position:** orient the pumper outlet toward the access lane or street.
- **Height:** center of lowest outlet should be 18 inches above grade.
- **Location:** within 5 feet of an access lane or street; preferably with no intervening parking.
- **Protection:** provide bollards if there is no curb between the road surface and the hydrant; locate at least 3 feet from the hydrant.
- Avoid locations likely to be blocked, such as loading docks.
- Position hydrants at least 40 feet from buildings they serve.

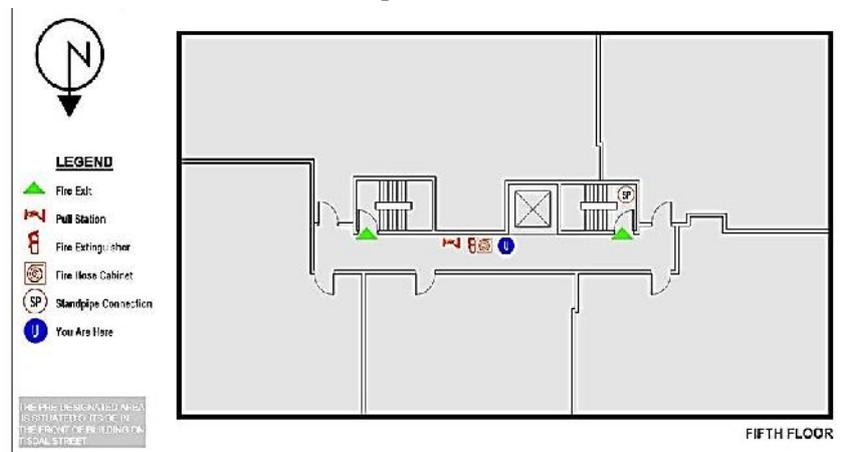
### A.2c PLANNING OF THE BUILDING:

- **Emergency evacuation (Ref. Fig.3):** Emergency alarms both audio (hooter type) and visual (flashing bulb) should be provided on each floor level at strategic locations. Meanwhile, employee/staff and security guards should be drilled for the same at periodic intervals. Access awareness training should also be given to security guards and staff handling persons with disabilities to refuge area during emergency.



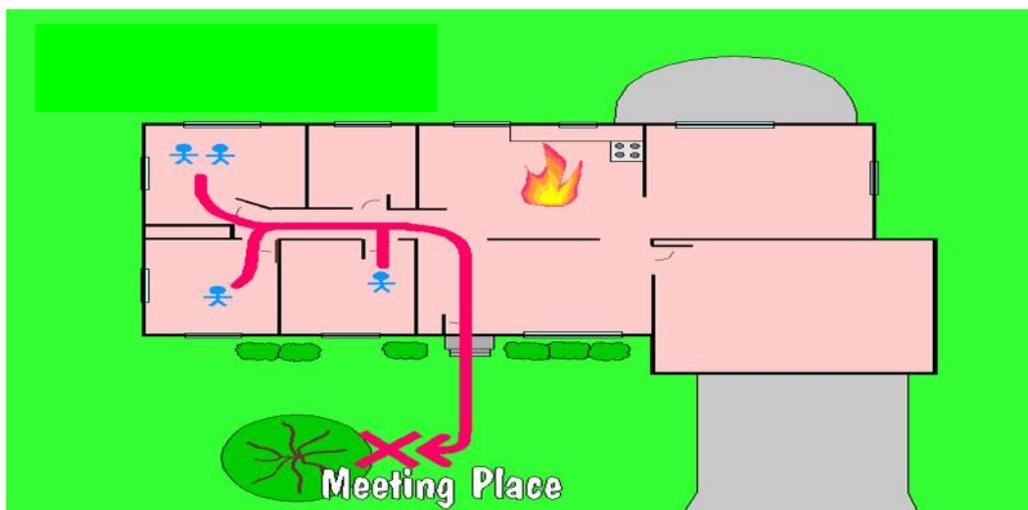
**Fig.3: EMERGENCY EVACUATION SIGNAGES**

➤ **Apartment Plans (Ref. Fig.4):** Apartment plans showing exit route should be fixed on each floor of the building in order to allow residents to exit in a quick and safe manner.



**Fig.4: APARTMENT PLAN SHOWING FIRE SIGNAGES**

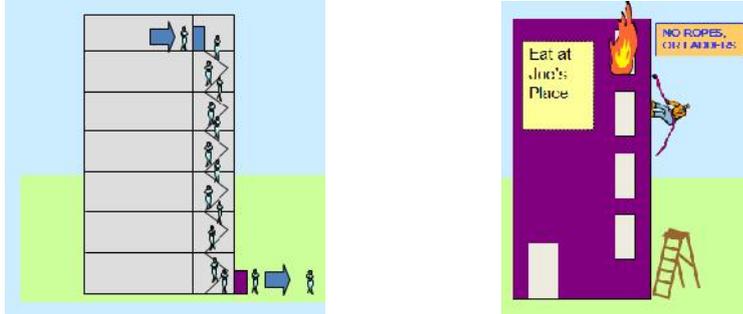
➤ **Exit Route (Refer Fig.5):** A continuous and unobstructed path of exit travel from any point within a workplace to a place of safety (including refuge areas). It consists of three parts: EXIT ACCESS, EXIT, and EXIT DISCHARGE.



**Fig.5: EXIT ROUTE DEMARKATION**

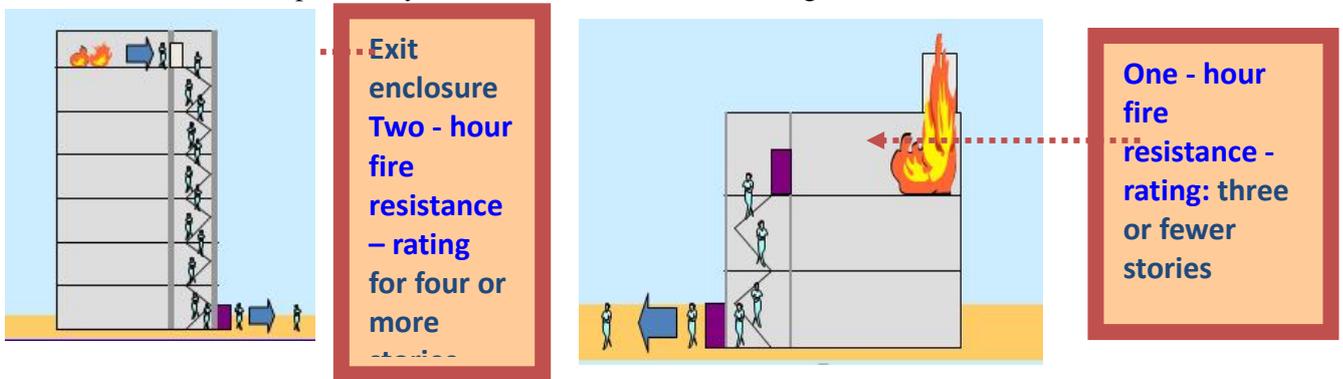
There are some basic requirements of an EXIT ROUTES:

- i. Exit route must be permanent (Refer Fig.6)



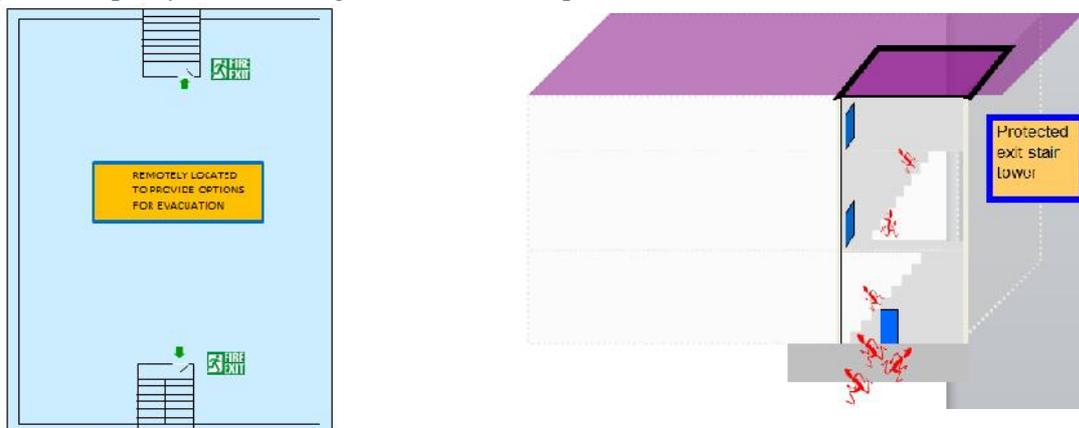
**Fig.6: PERMANENT EXIT ROUTE**

- ii. An exit must be separated by fire resistant materials (Refer Fig.7)



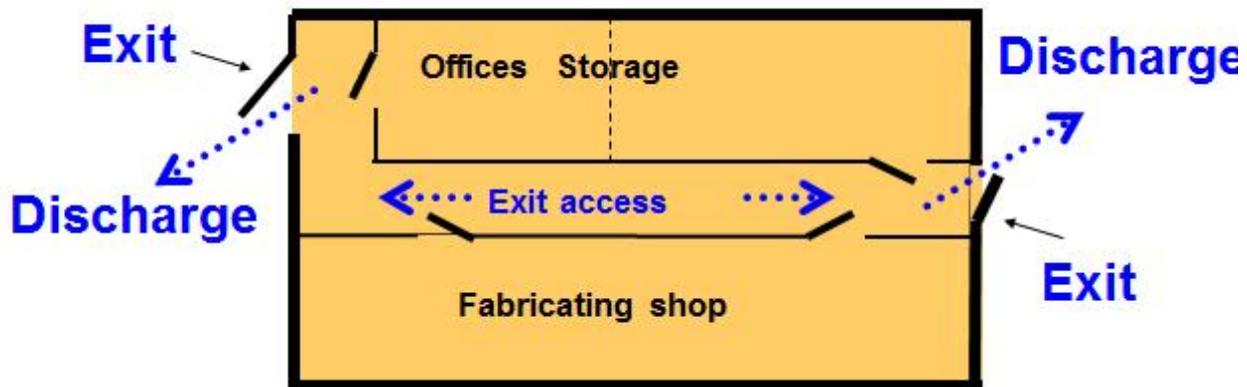
**Fig.7: PERMANENT EXIT ROUTE**

- iii. Openings into an exit (Refer Fig.8) must be limited to those necessary to allow access to the exit or to the exit discharge. An opening into an exit must be protected by an approved self-closing fire door that remains closed or automatically closes in an emergency.
- iv. The number of exit routes must be adequate. **Normally two or more depending on the size of the building, its occupancy, or the arrangement of the workplace.**



**Fig.8: OPENINGS IN AN EXIT ROUTE**

- **Exit Discharge (Refer Fig.9):** It must lead directly outside or to a street, walkway, refuge area, public way, or open space with access to the outside.



**Fig.9: EXIT DISCHARGE**

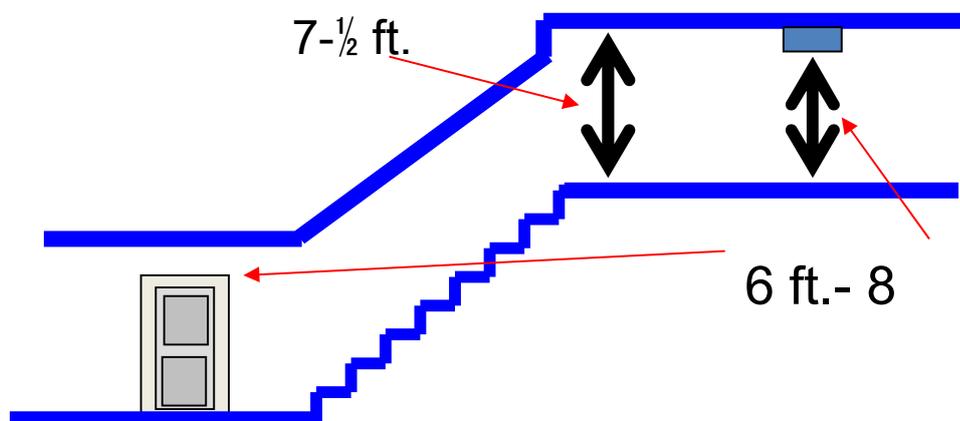
- **Exit stairs that continue beyond the level on which the exit discharge is located must be interrupted at that level by doors, partitions, or other effective means that clearly indicate the direction of travel leading to the exit discharge.**

**Exit doors** must be unlocked and must be able to open from the inside at all times without keys, tools, or special knowledge. A door that connects any room to an exit route **must swing out in the direction of exit travel** if the room is designed to be occupied by **more than 50 people** or contains **high hazard contents**.

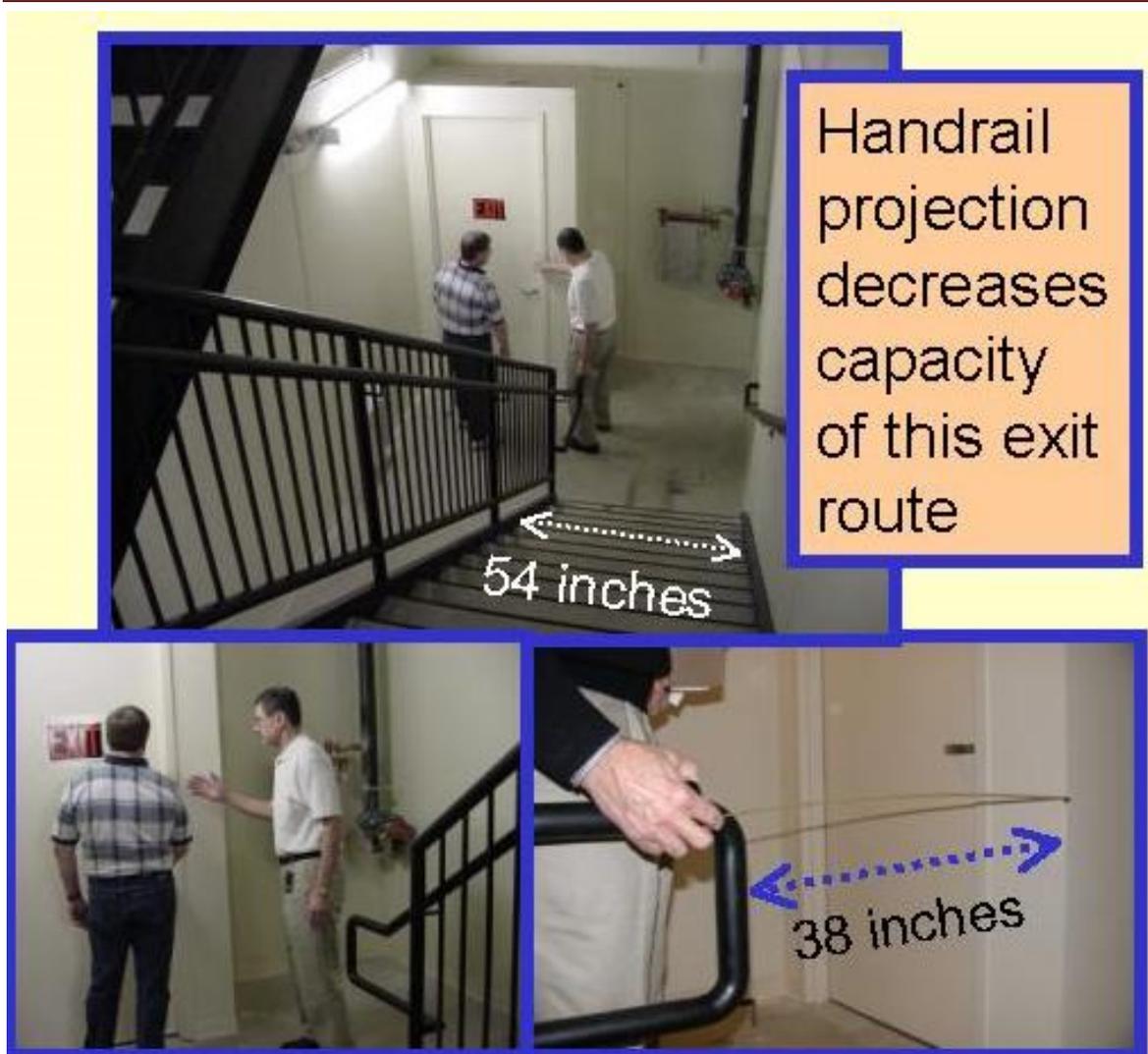
**Panic bars are permitted in an exit door.**

- **Exit Route Capacity:** It must support the maximum permitted **occupant load** for each floor served. **Capacity must not decrease** in the direction of exit route travel to the exit discharge. **Objects that project** into the exit route must not reduce the width of the exit route to less than the minimum width requirements for exit routes.

- Ceiling must be at least 7-½ft. (Refer Fig.10) high with no projection reaching a point less than 6 feet-8 inches. from floor. An exit access must be at least 38 inches (Refer Fig.11) wide at all points.



**Fig.10: CEILING HEIGHT**

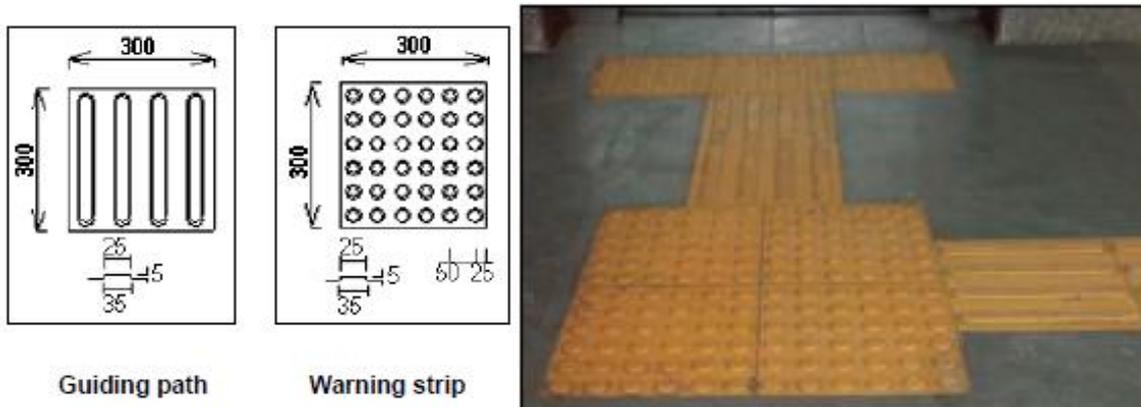


**Fig.11: EXIT ACCESS WIDTH**

### **A.3 EVACUATION ELEMENTS FOR DISABLED PERSONS:**

**Tactile surfaces: guiding strip and warning blocks** (Refer Fig.12)

- **Line type** block indicates the correct path to follow.
- **Dot-type blocks** provide warning signal, to screen off obstacles, drop-offs or other hazards, to discourage movement in an incorrect direction and to warn of a corner or a junction. It should be placed 300mm at the beginning and end of the ramps, stairs and entrance to any door.



**Fig.12: GUIDING/WARNING PATHS**

#### A.4 MINIMISING DANGER TO EMPLOYEES:

- Exit routes must be kept free of explosive or highly flammable furnishings or other decorations.
- Exit routes must be free and unobstructed.
- Arrange exit routes so that employees will not have to travel toward a high hazard area, unless it is effectively shielded
- Emergency safeguards (e.g., sprinkler systems, alarm systems, fire doors, exit lighting) must be in proper working order at all times.
- Lighting and marking must be adequate and appropriate.
- If direction of exit is not immediately apparent, signs must be posted along the exit access indicating direction to the nearest exit (Refer Fig.13).
- Provide self-luminescent markings where the backup power for the emergency lighting and exit signs is not of the self (Refer Fig.14).



**Fig.13: EXIT DIRECTION**



**Fig.14: SELF- LUMINESCENT MARKING**

#### A.5 SIGNAGES:

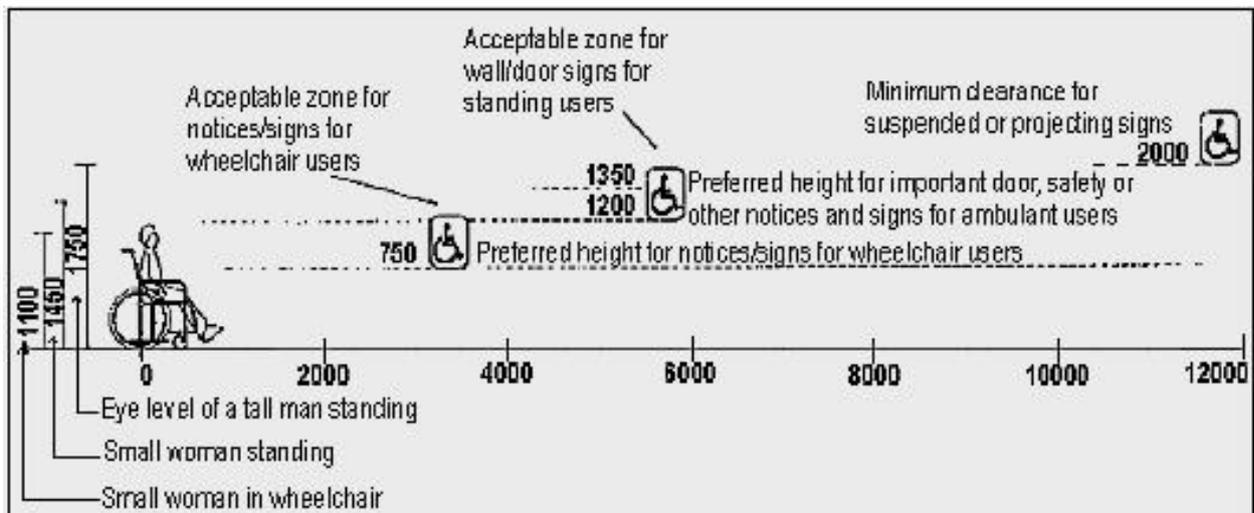
##### A.5 (a) CREATING AN EFFECTIVE DESIGN SYSTEM:

- Correct choice of sign design: Signs should provide clear, unambiguous instruction that will lead people directly to a final exit out of a building.

- **Location of signs:** Incorrect positioning can cause confusion and in the case of an emergency; could be life threatening.
- **Mounting height:** Signs are often mounted at unusual heights. Quite commonly a final exit sign is mounted in the middle of the door, as though it were a design feature.
- **The use of supplementary text:** Supplementary text helps to ensure the meaning of the graphical symbol.
- **Use of arrows:** Arrows are the clearest and most common of all the graphical symbols found in everyday life (Refer Fig.15).
- **Sign size:** The size of sign necessary to achieve this criterion will depend upon both the viewing distance and the illumination of the sign.
- **Position of signs:** If possible signs should be placed at eye level. Large signs which cannot be placed at eye level should be slightly inclined.



**Fig.15: USE OF ARROWS**

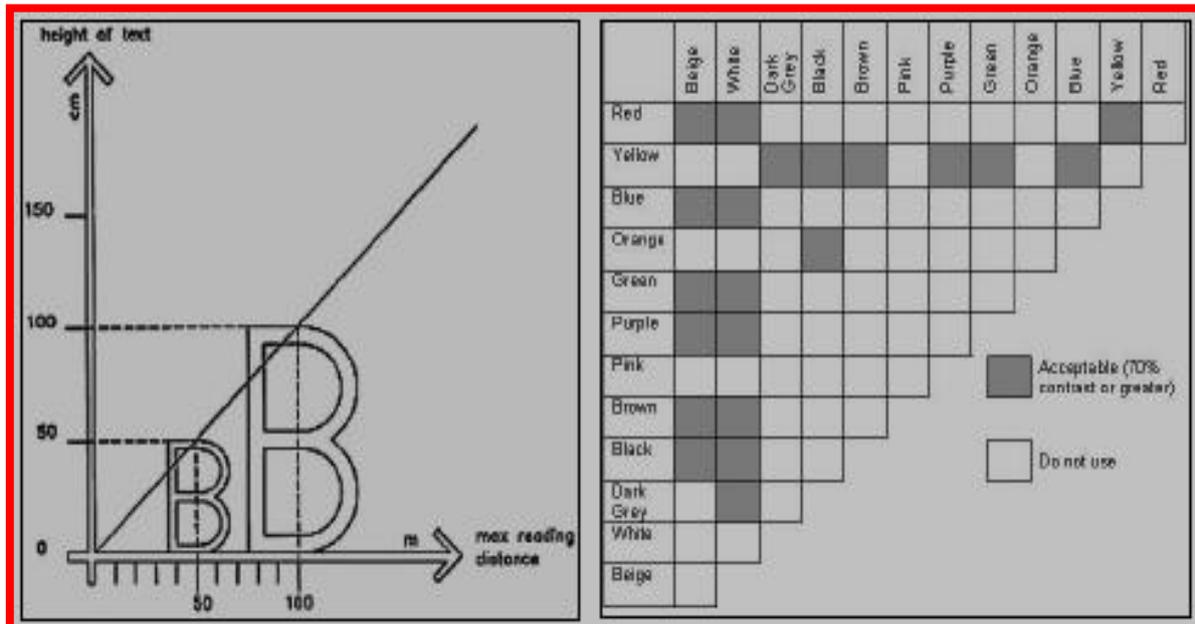


**Fig.16: POSITION OF SIGNS**

#### **A.5 (b) FONT AND SIZE OF LETTERS (Ref. Fig.17& 18):**

- Be in lower and upper case and left justified
- Non- glare color contrasted with their background

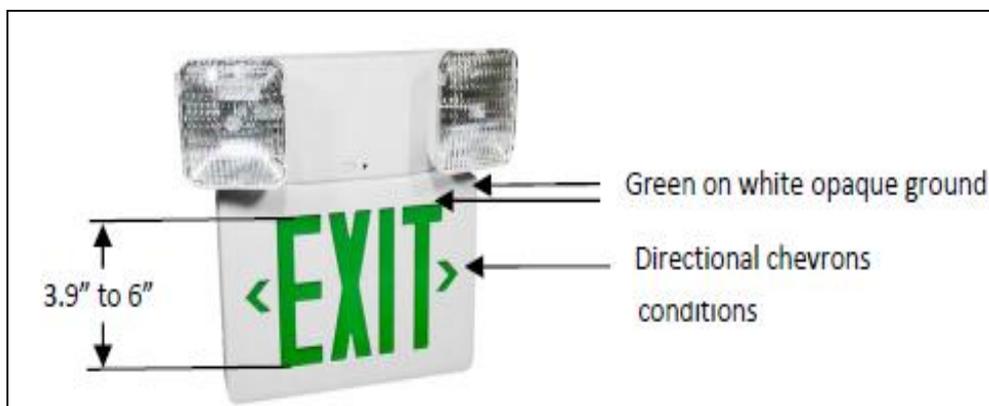
- Embossed with braille and braille locators – individual characters 15 mm – 50 mm tall, raised by 1- 1.5 mm
- Should be in both HINDI AND ENGLISH in INDIA.
- Font size
- Medium range sign – characteristics 70 – 100 mm high.
- Signage color and contrast basic principles:70 % contrast between wall and sign panel (Refer Fig.18)
- Avoid shades of color



**Fig.17: POSITION OF SIGNS**

**A.5 (c) TYPES OF SIGNAGES (Ref. Fig.17):**

- **CONVENTIONAL SIGNS** are those that are either illuminated externally (a dedicated light constantly shines on the sign surface) or internally lit (bulbs inside light up the signs letters).
- **ELECTROLUMINESCENT SIGNS** are coated with a nonradioactive, non- toxic substance that is activated by ambient light in the area of the sign
- When these two sign types have been compared, it was found that conventional signs had higher luminance and were more visible in smoke filled conditions (reference- Collins et al., 1992).



**Fig.18: FONT SIZE AND COLOUR CONTRAST**

**A.5 (d) DESIGN GUIDELINES (Ref. Fig.19):**

Characteristic	Recommendation	Research Needs
Font size	3.9 to 6 in.	<ul style="list-style-type: none"> <li>More research required. Findings inconsistent across studies.</li> </ul>
Text and symbols	No more than 1 symbol with text	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Directional indicators	Chevron with tail or triangle with tail	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Translucent/opaque	White opaque backgrounds more visible than translucent	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Luminosity	Highest best for smoke-filled environments, lower level in daily use to reduce glare	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Sign type	Conventional signs have higher luminance and are more visible in smoke-filled conditions	<ul style="list-style-type: none"> <li>More evidence required.</li> </ul>
Color	Green slightly easier to read on white background	<ul style="list-style-type: none"> <li>More evidence required. Findings inconclusive.</li> </ul>

**Fig.19: DESIGN GUIDELINES**

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#### A.6 REFERENCES:

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