



Evacuation Patterns in High Rise Buildings – Changes after 9/11!

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Escape rescue systems, Double Exit, Escape rail

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ABSTRACT

This article discuss about the different types of evacuation systems and their suitability to the different class of buildings. Modern day terrorism has made evacuation systems to be integral part of high rise buildings. Scientific and proper evacuation system design has evolved in the recent times after the 9/11 attacks on the World Trade Centre (WTC) in September 11th 2001.

INTRODUCTION:

A high-rise building, by popular definition, is a completed, occupied structure for which the roof access level exceeds the maximum height of rescue capability from street level.

A report after the 9/11 attack, the perspective of high rise buildings design changed phenomenally. The catastrophe claimed that most of the damage to the building which was due to the lack of fire resistant treatment to the various structural components of the buildings, also the fire exit stairs were not properly insulated. Due to the impact of the explosion, the lights in the stairway was damaged which led to delay in evacuation. Also activation of emergency power supply was difficult due to the panic at the WTC towers. After this incident the US government and the world realized that high rise buildings were prone to terror attacks. This led to the evolution of new systems of evacuation.

In most of the high rise buildings the safety issues regarding fire are neglected. Lack of proper fire escape spaces, improper fire escape design, improper positioning of fire extinguishers and mostly narrow staircases which often creates crowd and rush during fire incidents. After the 9/11 attacks on the WTC, the need for fire safety plans became mandatory because world realized that lack of proper fire exits lead to death of more number of people inside WTC. Evacuation plans for high rise buildings have always been debated. Legal considerations and studies of recent events involving high rise occupancies indicate complexity in design of evacuation system. Governing bodies/ Local Fire Departments are now taking a cautious look at both planning and elevation phases for certain habitations. (Mendis, 2003)

NEED FOR EVACUATION SYSTEM IN HIGH RISE BUILDINGS

Regardless of building construction, sophisticated fire detection system, fire protection, and fire-fighting equipment's used, a building is only as "people safe" as the building owners, managers, and tenant spokesmen want it to be. People cause fires by their acts of commission and omission, furnishings feed fires, and panic results in needless loss of lives and injuries. Fire prevention, fire protection, adequate evacuation programming and planning, and complete "rehearsal for survival" are needed to make sure losses will be zero or minimal in the event of fire.

Panic over occupants of high-rise buildings during the early stages of a fire is a danger that can contribute to highest casualty cases. Smoke, gases, and super-heated air make causes hindrance to trigger an emergency evacuation program. The record of fires in high-rise building occupancies, with resultant fatalities, and heavy financial losses emphasizes the urgent need for instituting an operative evacuation program.

The latent for high human losses makes it overbearing that evacuation programs be reviewed and updated as required. Hysterical evacuation complicates emergency situations because of differences in design, construction, fire-resistant qualities, height, floor layout, usage, and occupancy. Each building presents unique problems in emergency evacuations. For this reason, information contained in fire safety data sheet by the concerned fire department or agency should be considered as a guide to an evacuation program rather than a specific program standard for any one particular building. State or provincial and local codes and regulations concerning fire and emergency evacuation should be checked, and, where variances exist, the more applicable measures should be adopted. Fire control and evacuation authorities should be consulted for suggestions relating to a particular building.

TYPICAL FIRE ESCAPE PLAN IN BUILDINGS

Fire has been a number one danger ever since the day, many eons ago, when our prehistoric ancestors got the idea of bringing fire indoors for cave heating and knitted mammoth cooking. Since then accidents resulting in the damage of households have occurred due to misunderstanding, miscalculations and misuse of this powerful force of nature. Today, fire is, without doubt, the single most immediate threat to people and residential property.

An emergency escape plan that clearly outlines all the utilities/common utilities in your buildings including lifts, lobbies, hallways, stairs, windows and doors should be displayed at key corners of the buildings, also include a safe assembly point and the escape plan should clearly specify how to reach the assembly point. Also significant exterior landmarks such as trees, shrubs, paths, patios and driveway should be a part of the escape plan. The plan should clearly outline at least two ways out of each room, a door and a window, for example. This is especially important for bedrooms since most residential fires occur while the family is asleep. The easier of the two should be the primary route (usually the door). The window should be used if fire prevents the door from being used. A well-thought-out escape plan is a good start. Practice makes the plan a real lifesaver. An integral element of an escape plan is a preset designated meeting place where everyone should gather once safely outside.

RECENT ADVANCES IN EVACUATION SYSTEMS

1. Escape Rescue Systems, Israel

Israel is the world leader in skyscraper evacuation systems because they have learned to capitalize on their own experiences with terrorism. The need an advanced evacuation system was a priority after the 9/11 attacks. Also when the construction of the new WTC begun, the experts' panel felt to have a state-of-the-art new technology which is efficient and adoptable for high rise buildings. This system was initiated

with a new escape pod for high-rise buildings. This system was tested at Tel Aviv in Israel on some of the high rise buildings which found that this system is lot more efficient than the previous evacuation patterns.

Some of the salient features of this evacuation system are:

- Evacuates 300 people every eight minutes in a pod that resembles a lifeboat on a cruise ship.
- Wireless communication activates the system.
- Height is not an issue for the system, but perhaps it is for those occupants with even only a slight fear of heights.
- System can be retrofitted to existing structures for a cost of about \$2 million for a 40-story building, requiring only 430 square feet of roof space.
- Firefighter access is provided with the return ascent trip to the top of the building.
- Since it's controlled by wireless communication, there are less chances of the system failure by damage to wiring of the evacuation system. However, the entire failure of the system can be called as an exceptional failure case.

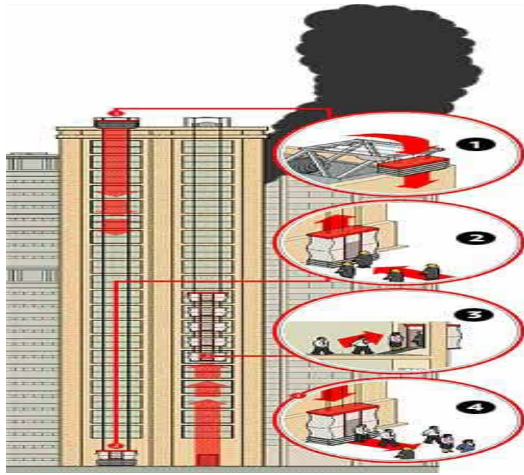


Figure 1: Image showing the rescue operation

Step 1: The rescue operation is initiated with a wireless communication device when fire incident is reported in the building.

Step 2: The level of the building which needs urgent attention is located and the POD is communicated with the same. The POD positions itself to the location of rescue. All the operations are controlled by a wireless communication.

Step 3: The condensed POD opens itself and allows the occupants to get inside. Provision is also made to ensure even physically challenged occupants can also board the POD, hassle-free.

Step 4: The POD after reaching the ground level. The POD opens itself to evacuate occupants of the building safely and is ready for the next trip to rescue the occupants in danger.

Suitability:

- ✓ High Rise Buildings (G+25 floors).

Drawbacks:

- ✓ Only trained security/safety staff can operate this system.

2. Double Exit System

Salient features are:

- The sensor connected to an emergency alarm is triggered during a fire accident.
- After the sensor gets activated, the Double Exit rescue system is ready to use.
- The evacuation system is simple. Just hook up to the harness connected to the cable and exit by a window or a balcony whichever is free from fire.
- The system then lowers down the occupant at a steady

speed of 1.5m/sec. Once the occupant reaches ground level, the double exit system is now ready for another trip to rescue occupants.

- It can rescue unlimited number of occupants and can carry a weight of maximum of 150 kg per trip.

Components of the Double Exit System:

The entire system is embedded inside wall with a fire resistant door protecting the system.

The door opens automatically whenever there is fire and enables the occupants to use the systems. The various components are listed below:

1. Emergency lighting
2. Smoke and heat detectors with alarm
3. Fire resistant steel rescue cable
4. Harnesses
5. Gas masks
6. An Axe
7. Other necessary accessories

Suitability:

- ✓ High rise Residential Blocks.

Drawbacks:

- ✓ This system is clumsy for physically challenged and senior citizens.

3. Escape Rail System

Escape rail is one of the best solutions for fire emergency. It is a unique pattern wherein number of people can be rescued within no time. Escape rail is an external railing system which can be used for the following operations:

- A. Evacuation
- B. Building Entry
- C. Communications
- D. Remote Fire Fighting
- E. Motorized Scaffolds Brackets installation

The pre-installed railings in vertical direction around the building are innovative ideas towards rescue of occupants during fire accidents and terror attacks. These pre-installed rails guide the occupants from the site of fire to a safe location. The rails move at a constant speed to evacuate any number of people from the building before the fire responders arrive to the site. Also a hydraulic powered car can be used to reach the occupants in the top most floors of a building using the pre-installed railings on the building. By using these hydraulic powered cars we can reduce the traffic congestion due to parking of too many fire fighting vehicles at the buildings during fire accidents.

Escape rails can also be used to eliminate the communication gap between the occupants and the fire defendants during evacuation in a high-rise building. This is done by elevating a radio repeater on a platform of the tract system, which can be used to communicate escape routes to the occupants trapped inside the buildings. Also the railings can be used to convey a remote firefighting assembly (Refer Fig 2.a) to shut off the fire at higher elevation of the buildings during fire accidents. Additional benefit of the escape rail is it can be used to assemble a motorized scaffold brackets (Refer Fig 2.b) to assist evacuation of physically challenged occupants/senior citizens.



Figure 2(a): Remote Fire Fighting

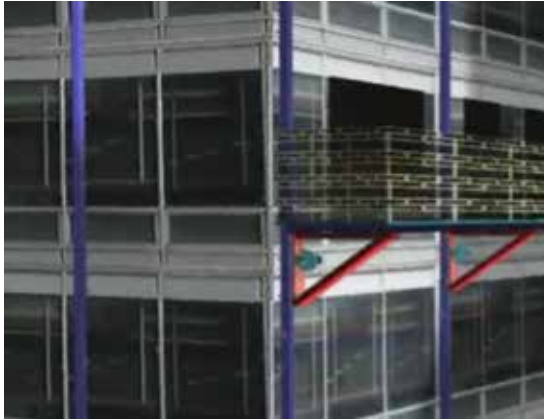


Figure 2(b): Motorized Scaffold Brackets

Suitability:

- ✓ All type of high rise buildings (office spaces, residential units etc.,)

Drawbacks:

- ✓ This system is clumsy for physically challenged and senior citizens, also provisions for the escape rails have to be maintained appropriately to ensure suave evacuation.

CONCLUSIONS:

Fire rescue systems have to be made mandatory by the Governing bodies or Safety Council's for all buildings. Proper scientific planning of the rescue systems needs to be incorporated so that minimum or no damage to human life is caused, also depends upon the size of the building and no. of occupants the type of evacuation system to be instigated. An awareness sessions/ mock drills by local Fire Department must be held to educate the building occupants with the do's and don'ts during a fire incident clearly explained. Mock drills should be conducted regularly to ensure the occupants are trained and on the other hand rescue systems are working fine. Fire Escape route plan should be displayed at all important scenes of the buildings. Education about safe practices to avoid fire accidents is really an important goal to be achieved within the community. But one of the basic modes of evacuation, the escape through stairs should be given more importance as it can ensure more occupant evacuation than any other evacuation procedures.

REFERENCE

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