

Building Evacuations FAQ's

Following the catastrophic collapse of the World Trade Center towers on September 11th; numerous questions have been raised relating to the evacuation/relocation of occupants in high-rise building emergencies. While a fire is the most likely emergency scenario the building occupants are likely to encounter, other perils that may require total or partial building evacuation exist including tornadoes, bomb threats, major earthquake and even extended power outages. The aftermath of the terrorist attacks at the WTC reminded the public to be prepared to take action for any building emergency. Total building evacuation may be the norm until some sense of comfort is brought back into the picture. Our views on Building Evacuations FAQ's based on what we know about building evacuation during a fire or similar emergency, offer the following answers for those who are interested in this topic. But we don't know all about the atypical event, such as the terrorist attacks.

Is high-rise building evacuation different from other buildings?

Due to the high occupancy, it is not practicable or desirable to carry out total evacuation in a typical fire emergency. Instead, tall building is designed and constructed to allow for a phased evacuation. The construction, fire protection and life safety systems installed in high-rise buildings, including automatic sprinkler protection, are designed to control a fire so as to lessen the need to evacuate all occupants to the street level.

Nearly every city with high-rise buildings has embraced the staged evacuation or staged relocation concept, this is a version of the defend in place strategy. The occupants of the fire floor and floors immediately above and below it should immediately use the exit stairs to descend to a floor level that is at least a few floors below the fire floor. The occupants can then reenter the occupied space on those safe floors so as to await further instructions, with progressive extensions to the evacuated area if the fire risk persists. Another by-product of this approach is also the need to minimize or reduce business interruption or productivity. Nonetheless, total evacuation is imperative when the building faced with imminent danger from terrorist threats or attacks, such as in the September 11 tragedy. These building systems are designed to control a challenging fire but not one caused by a commercial airliner crashing through the side of the building.

How are emergency instructions tailored to the actual emergency event and communicated to building occupants?

High-rise building fire alarm systems are required to have emergency voice communication capability. Trained emergency personnel assess the emergency and can then broadcast a variety of specific messages to the occupants. The occupants believed to be in the greatest potential danger are instructed to use the exit stairs to begin their descent. Occupants of other floors might be instructed to stay where they are and await further instruction. In these cases, only occupants on the fire floor and the floors immediately above and below typically receive the message. Should the scale of the emergency increase, the announcements can be expanded to include additional floors, or if need be, the entire building.

If the neighboring high-rise building is on fire, should my building be evacuated?

Not during a typical fire. You should remain vigilant and determine if there is any change in conditions that could result in your building being threatened by the adjacent fire. In such cases, emergency personnel have adequate time to order such evacuations.

If I stay and then the situation becomes untenable and I am trapped, should I break a window? Should I jump?

If you are trapped in a high-rise building, try to locate yourself in an area where you can close the door and seal the cracks to keep smoke out. Use a telephone to call the fire department and report your exact location in the building. Try to be patient. Emergency rescue of high-rise building occupants can take a long time. You can signal your position to rescue personnel from a window using a light-colored cloth, but it is not advisable to break a window. If you can open the window slightly, it is generally safe to do so to allow fresh air in, but be prepared to close it if smoke comes in. A broken window cannot be adjusted to block smoke from pouring in. Finally, falling glass from a broken window can sever fire hoses and severely injure rescue and suppression personnel below. It is very dangerous to use a window for escape from anything higher than the second floor.

Is the building egress system in high-rise building designed to cope with total evacuation?

While exit stairs in tall buildings are indeed designed to accommodate total building evacuation, there are practical matters associated with always having to empty the total building population. Some of these items include:

1. **TIME TO EVACUATE** Total building evacuation in certain structures may easily take one hour or more. During this time, occupants in a well designed, but still crowded exit stair may be injured, or may simply feel that so much time was completely unnecessary for a small, manageable and quickly contained fire-the 'typical' fire that occurs in the tall building environment.
2. **TIME TO RE-ENTER THE BUILDING** Tall buildings are not designed to have the total building population show up at exactly the same time. Elevators are designed based upon the total number of floors and total number of expected occupants. They are not designed to deliver all occupants to all floors at the same time. Populating the building at the same time, assuming most occupants would utilize the elevators, may be a two-hour process depending on the size of the building.
3. **HISTORICAL EXPERIENCE** The collective experience in high-rise and tall buildings in most countries shown that the defend in place concept works in typical fire situation but not under terrorist threats or attacks.

How is high-rise building evacuation different from simply leaving the building upon being notified to do so?

The multiple floors of a high-rise building create the cumulative effect of requiring great numbers of persons to travel great vertical distances on stairs in order to evacuate the building. In a typical scenario of high-rise building evacuation, it is believed that 20% of the occupants need assistance to use stairs in an emergency. In addition, firefighters

will need to use at least one staircase for fire suppression and rescue operations, thereby eliminating one staircase for egress. Hence, the total evacuation in high rise is a very hazardous operation and it would take many hours to safely move all the people out of a blazing building.

In the 1993 bombing of the World Trade Center, for example, we learned that in some cases it took as long as 6-8 hours for the tens of thousands of building occupants safely traversed some five million person-flights of stairs to successfully exit the buildings. The physical demands made on high-rise occupants exiting in stairwells can exceed their capabilities.

Will the defend in place strategies be enough to protect the disadvantaged with severe mobility impairments in a major emergency?

In this, or any similar response to building emergencies, some difficult questions arise as to the need to defend the mobility-impaired occupants. At present, modern building codes either provide areas of refuge on each floor, or in the case of buildings with automatic sprinkler protection, provide access to at least two compartments on each floor. In typical fires, these protection features are more than adequate. These design elements provide a safe environment while occupants await rescue. However, the mobility-impaired people would need assistance to use stairs in leaving the building in a major emergency that call for total evacuation.

What procedures should be applied to people like me who are confined to a wheelchair?

Able-bodied as well as disabled occupants must be covered under any written procedures. If your floor has to be evacuated, you should plan to horizontally relocate to a refuge area. In buildings with automatic sprinkler protection, this may simply be to an adjacent compartment or office space. In other cases, your building may be provided with areas of refuge. These spaces may be located as stand alone, barriered compartments on the floor, or they may consist of oversized landings in the stair well. Regardless of which feature you have, your plan includes waiting in one of the designated spaces until fire department personnel can remove you. Often times, these spaces are provided with a two-way communication feature so you can keep rescue personnel informed of your location. Your work environment may also supplement this procedure with a 'buddy' system. In this case, you need to anticipate situations where the buddy is not available or nearby should an emergency occur. In every case, and regardless of one's abilities, if you have any questions about your building's plan or how you fit into it, you should ask your employer for detailed information and request a role for those with disabilities in crafting the plan.

What methods are used to move people in a wheelchair or with other disabilities that affect mobility to the ground floor in a major evacuation?

Currently, there is no legislation for building owners to include structural fire safety features to meet the vertical escape needs of the disabled. The mobility-impaired people would need assistance to use stairs in leaving the building in a major emergency that call for total evacuation. This can be a slow, dangerous, strenuous and painful process that could also jeopardize the lives of those rendering assistance. Also, if there is smoke in the staircase containing fleeing occupants, poor visibility adds to their

difficulty. This dilemma engages a 'fairness' debate on if one person can potentially slow the progress of what could be many hundreds.

Under what circumstances may the disabled use the elevator safely?

Use of elevators by the disabled are simply not practical in actual buildings during emergency events. Elevator use is difficult to control. It is unlikely that able-bodied persons could be kept off of elevators if they thought it would get them to the ground floor more quickly. There is simply no mechanism that can restrict the elevator use to those who need it most. In addition, elevators are designed to go to a predetermined recall level, normally the lobby when a fire occurs. If there is a malfunction of any type, the elevator may inadvertently travel to the fire floor, thus exposing occupants to the fire. Elevator shafts may also allow some smoke to enter the shaft and migrate toward the roof of the building. If they are in the elevator and there is smoke in the elevator shaft, they will expose to that smoke.

What alternative means of vertical escape are available to people in a wheelchair or with other disabilities that affect mobility?

The development of "Accessible Means of Escape design", a way out of a building or structure, that provide route choices for vertical escape in a enhanced stair enclosure, maximizes safety and usability for all people, including the elderly and severe mobility impaired persons in an emergency. This egress design incorporates the facility of multiple escape chute system inside the enhanced staircase enclosure. The stair enclosure is constructed in accordance to local fire code that provides protection from fire effects for evacuees so that it can be used safely for egress. When fire occurs, severe mobility impaired people and the disabled will have to make their way, assist or unassisted, and take temporary refuge inside this stair enclosure while waiting for rescue. They can either choose to use the chute inside the stair enclosure that would get them to the ground floor more quickly or to be assisted by helpers down the stairs. Presently, it is non mandatory for building owner to provide structural fire safety features to meet the vertical escape needs of the disabled. We have to rely on the conscience of owners and developers to provide such system.

If stair travel can take so long, am I better off to go up to the roof to await rescue if that's closer?

No. Using helicopters for roof rescue is an extraordinarily dangerous procedure for the occupants, the pilots and firefighters who may be in or around the building. In severe fires, the large thermal currents, generated by the heat from the fire, can cause the helicopter to be buffeted up or down, making it hard to control. The resulting down thrust from the helicopter rotor can force smoke and super heated air on top of fire suppression personnel. Finally, ascending to the roof may prove a waste of valuable time, as it may be impossible for a helicopter to approach the roof. Most building designs incorporate numerous features that direct occupants to the street or grade level for evacuation purposes.

If stair travel is taxing and potentially dangerous, are there any alternatives?

Yes. There is an alternative means of vertical escape that can be incorporated in the building egress design to supplement stairwell escape. Collectively, these elements worked together to provide a quicker and relatively safer means to move all the building occupants to the ground in the shortest possible time.

Multiple-Entry escape chute: This multiple escape chute system is installed inside a protected vertical shaft enclosure that is constructed in accordance to local fire code that provides protection from fire effects for evacuees so that it can be used safely for egress. This interior chute is constructed of 2 layers, the outer layer provides a speed restraining effect, and the inner layer supports the whole weight of chute. The chute is installed in segment at each floor level inside the fire-protected shaft, one segment of chute per floor, from the highest floor to the ground floor on the same vertical line. One chute serves many floors and occupants can gain access to the chute at each floor. It has no length and height constraints. The longest one in use is 165m at the Nation Tower, Bangkok, Thailand.

Should my building have any type of exterior escape device?

Only those exterior escape device that is designed to the level of protection and can be used for mass rapid evacuation be provided as supplement escape routes in special structures, such as some towers and special manufacturing environments, and even in commercial and public buildings for vertical escape.

The “Single-Entry escape chute” is one such device. It is a permanently fixed chute installation in old or existing building, installed at window, balcony, rooftop, best serves the occupants of that particular floor. This exterior chute is constructed of 3 layers, the outer layer is fire resistant – protects the chute against flames, the middle layer provides a speed restraining effect, and the inner layer supports the whole weight of chute. This 3-way protection protects the evacuees once inside the chute from fire, heat, and smoke during evacuation. Available in a maximum length of 200m, the longest such chute in use to date is 122m at Intraco Building, Warsaw, Poland.

Do the alternative means of vertical escape, such as escape chute comply with local fire code regulations?

In the context of our local fire code regulations, it is not required to provide escape chute in a building for escape or rescue purposes. However, the Fire Safety Bureau of the Singapore Civil Defence Force has no objection for it to be used only as a supplement in addition to the required exit provisions. Building owners may provide appropriate additional facilities to meet their requirements. In many situations, the escape chute is acceptable by fire authorities in many countries as practical alternative to a second staircase, for vertical escape. It has been used to get the disadvantaged who have no ability to use stairs to the ground floor more quickly.

How can I judge if my building's evacuation plan is adequate for any emergency?

It is highly likely that the procedures are adequate. In our society, we plan on events that are likely to happen in a building or structure. In large part, evacuation procedures are geared toward an unintentional fire occurring in a building. Often times, these procedures are also robust enough to contemplate deliberately set or incendiary fires as

well. Your building's evacuation procedures should make clear to you and all occupants the actions you are to take, and when to take them. Although not mandated for all buildings, most fire authorities, requires that workplaces, healthcare facilities, educational institutions and other occupancies provide evacuation/relocation plan information and routinely schedule and hold drills when practicable. If you are on the upper floor of a high-rise building, this may be a good opportunity to practice and experience your plan.

Will the building egress systems work in a terrorist attack?

Prior to the events of September 11th, a suicide pilot of a jetliner was not a credible or foreseeable building design hazard. Current building evacuation or relocation procedures consider the need to move occupants from harm's way with a fire that grows at a very predictable way at a rate that is typical to the anticipated fire hazard in the building. These building egress systems are designed for typical fire emergencies but not terrorist attack, such as the one caused by a commercial airliner crashing through the side of the building.

What happens when the event is not typical?

As with any situation in our daily lives, you are ultimately in control of your fate to a great degree. Thus, you are largely responsible for your own personal safety based upon the circumstances. Standard operating procedures, verbal instructions and even past experience may not be adequate to help you deal with extraordinary events. A good guideline to follow is based on the acronym, **RED**, the universal color for danger can be used to help you in such circumstances.

REACT: Take any indication of smoke, fire or other potentially threatening situation seriously. Activation of building fire alarms, smell of smoke, visual indication of flames, warning from other occupants, arrival of the fire department are some of the attributes that may signal an imminently dangerous situation.

EVALUATE: You must judge the level of threat. This includes confirming evidence or presence of smoke or fire; judging the conditions in your immediate area; consider additional information being received. A difficult part of this process involves your own capabilities as well as the capabilities of others to relocate or evacuate. Can you negotiate 50 flights of stairs? Have you been assigned as a buddy to a mobility-impaired co-worker? The essence of this feature is to determine if you are in immediate danger, or if the evidence of peril suggest otherwise.

DECIDE: There are only two, but difficult choices:

1. Follow your plan and immediately leave the building.
2. Follow your plan and stay where you are, or descend to the designated level below the fire floor and be prepared to take protective/defensive action. In this case, anticipated action may include alerting the fire department of your location, seal doors, windows and vents that lead into your space. Do not break out the windows. Be prepared to wait for a considerable time period (at least one hour) if you contemplate rescue by the fire department.

This process is iterative. It is not only done at the first hint of a dangerous situation. It is a process that the individual must manage and it needs to be repeated until the danger has passed or, if total building evacuation is in order, when that action is completed.

These Building Evacuations FAQ's are by and large based on we know what we know about the normal or typical fire in a building. Self-preservation measures, however, become incredibly complex when the extreme event takes place. Even given the ability to drill, review building procedures and study the building exits, you are still ultimately responsible for your own decision.

Information contained herewith are expressed opinions gathered and compiled by Escape Consult Mobiltex (S) Pte Ltd. for those who are interested in this topic.