Supplemental High-Rise Evacuation

Authorities in many countries have make it mandatory for owners of designated premises to draw up plans to cater not only for fire emergencies, but also address other fire related emergencies or hazards affecting life safety. This is regardless of whether the hazard is initiated by accident, pre-meditated actions, or natural causes such as earthquake. So, what evacuation technologies are commercially available to address the limitations of the building egress in enhancing an emergency response plan for safe evacuation?

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There are many reasons that may cause the movement of people in an emergency in a building, such as fire, acts of terrorism, earthquakes or major power outage. In these situations, occupants may need to evacuate the building as soon as possible. In dealing with such emergency evacuations, the evacuation of people with special needs and the blockage of escape routes are of critical important because as they will increase escape difficulties and evacuation time.

People today are not comfortable with long egress times. Yet, the use of passenger lifts for emergency evacuation is not advisable due to the potential for people to be trapped if the power supply is interrupted and the danger of the lift being opened inadvertently on the fire floor, potentially exposing occupants to danger. The use of an evacuation lift, if available, will always be the best option for the vertical escape of those who require assistance. A fire lift is intended to provide

a vertical means of access for firefighting and rescue operations and should not be designated as an evacuation lift unless there is more than one fire lift provided in the building. The process of vertical evacuation is highly labour intensive and can be chaotic without a proper evacuation plan and coordination.

Traditionally, dealing with emergency evacuation is by code compliance. Even though various egress designs can be code compliant to meet their original occupancy needs, they will perform differently in emergency evacuations. Some may lead to a shorter evacuation time; some may prevent occupants to escape efficiently. Fire is the most complicated emergency in terms of emergency movement because of the rapid change to untenable conditions; the blocking of spaces will change with time due to the smoke movement to other areas and the blocking of some exits.

The changing demographics and the public

concerns about safety in the evacuation of tall buildings are the prime movers in the development of new evacuation techniques to accommodate people with special needs of any physical condition, be it age or impairment. These concerns have also led to a call for a fundamental rethinking in the use of evacuation technologies to supplement the traditional methods of building evacuation.

Supplemental Evacuation Technologies

Taking the lessons learned from 9/11 and terrorist attacks against hotels and other iconic buildings, America's leading fire safety body, the National Fire Protection Association (NFPA), issued new Life Safety Codes approving the use of "Supplemental Evacuation" (SE) technologies to assist people exiting high-rise buildings in an emergency. The NFPA has also provided guidance to building owners and others considering the voluntary use of such systems and equipment. If provided, it is not intended to replace existing code-mandated exits or stairwells but rather to offer an alternative means of egress when traditional escape routes are blocked or unsafe. Exceptions to this include the sick, injured or impaired for whom new S/E technologies should be considered in giving them a chance of escape from danger.

NFPA also approved the use of supplemental evacuation technology in official and/or mandatory evacuation plans. If SE is provided, it should be used in accordance with the building evacuation plan as, for proper use, no single set of requirements can cover all contingencies. The plan should include deployment by the authorised person(s) to provide supplemental evacuation means or a means of escape for people who cannot use the standard means of egress. Staff and the person or persons authorised to direct the deployment and operation the system should be trained in its procedures. Generally, deployment will be when preferred options no longer exist or, when all other means of egress or escape have been compromised; just as the deploying a lifeboat from a sinking ship.

Supplemental Evacuation Resources

The Supplemental Evacuation resources provide redundancy and survivability into the building evacuation system, while also alleviating problems related to building evacuation in emergency situations. This article examines the capabilities and features for a range of innovative SE resources and its usefulness to the in-house emergency response team.

• Escape Chutes

There are different versions and types of escape chutes – vertical sliding descent, spiral sliding descent, and slope sliding descent – and the chute constructions also different from one manufacturer to another.

One particular escape chute, Ingstrom Escape Chute, allows people in high-rises and other tall structures to safely slide vertically down to the ground. This evacuation chute has special characteristics and safety features that are uniquely different from other chutes. The chute has a three-layer construction made up of technical fabrics that protect users from flame, heat and smoke. The inner layer is made of Twaron and a PVC chlorofibre that is extremely strong (up to 5,600 kilogramme-a-metre width) and heat resistant up to 650°C. The middle layer is a flexible elastic fabric made of Lycra and modacrylic fibres. This layer acts as the 'brake' – think of knee support fabric – for the evacuee, who can control the speed of descent by extending arms or legs. The outer layer is made of tough, fibreglass that can withstand temperatures of up to 750°C. The unique feature in this chute is that the chute sleeve construction does not consist of springs or steel coil as in other chutes.

In essence, these long tubes offer exterior and interior egress path solutions, ranging from single-entry and multi-entry to mobile rescue systems. The single-entry system is an exterior egress solution that is intended to provide alternative paths of egress in the case of critical compromise of the primary path, and to provide additional paths of egress to alleviate congestion in the primary path. Egress path inside the chute tube protects users from the effects of fire. It is permanently installed at a fixed location for use as an "emergency exit". It can be retrofitted or mounted on the rooftop, balcony or corridor, window ledge, or other special evacuation opening in the building, giving occupants access to the chute on that floor. One chute serves one floor and the maximum length of the chute for this solution is 50 metres.

The multi-entry system is an interior egress solution permanently installed inside a vertical shaft/duct inside the building whereby one multiple chute serves several floors. It allows occupants to gain access to the chute at each floor or at each alternate floor where several levels can be simultaneously evacuated. There is no limitation to the height of the building for multi-entry installation. The mobile-rescue system is an exterior egress solution mounted on the bucket of a fire department's aerial platform used for height rescue.

These systems are accepted by fire authorities in several countries as a practical alternative to vertical escape, in particular where there are space constraints for the construction of a second staircase, as is often the case with older buildings. These systems are also installed in high-hazard industries as a practical alternative to vertical escape in life threatening situations.

Controlled Descent Devices

One particular controlled descent device, the MARK Save A Life, is a relatively safe, simple, low cost self-escape/rescue system for high-rise structures. The unique feature of this device is its double self-braking systems that provide a continuous automatic "hands off" operation and a lifeline to the ground for buildings up to 300 metres high. As one descends, the other rope ends comes back up for immediate reuse. Speed of descent: approx. 0.6 metres-a-second and the maximum load for descent is about 150 kilograms.

It is an exterior egress solution that is intended to provide alternative paths of egress in the case of critical compromise of the primary path. It can be installed at the rooftop, balcony or corridor, window ledge, or other special evacuation opening in the building, giving occupants access to the system on that floor. The portability and flexibility of the system provide an efficient and cost effective strategy to create multiple "escape stations" at strategic locations in the building. Where utilised as part of the building exit strategy, one or more systems serving each floor can have an impact on the safe evacuation of occupants. This pre-planned approach would provide everyone inside the building with ready access to an evacuation system in the event of life threatening emergency. It also enables the system to be relocated to another pre-planned safer location away from fire. The system can also be moved to another location when the company moves to a new premise of similar height.

MARK Falcon is the standard model with basic feature used in multi-level buildings for self-escape. MARK Hawk is a rescue device that has two open eye bolts added to the standard model. This rescue device was developed for professional users, such as the fire services. It also provides a practical vertical escape solution for workers working at height to descent quickly from danger.

Evacuation Chairs

Accessibility regulations have resulted in a growing number of occupants with mobility limitations requiring egress assistance in "special needs evacuation planning" that would enable them to get down and out of high-rise buildings in an emergency. This includes the consideration of the evacuation capabilities and needs of occupants with disabilities; either permanent or temporary.

One particular evacuation chair, the Evac+Chair, is internationally accepted for the stairway evacuation for people with reduced mobility, who would have difficulty leaving the building when the lifts is out of service due to breakdown, under maintenance, power outage or in an emergency. The chair is engineered to convey smoothly using a patented continuous rotating V belt that ensures safety and allows the user to control the chair's descent down the stairs with relative ease, regardless of the passenger's size. The chair is designed to allow people with mobility difficulties to be helped to move down stairs and, in some case, up stairs during an evacuation. Evacuation chairs are used where it is not safe to use lifts to evacuate, or

where an evacuation chair is less risky than having a disabled people remaining behind in a refuge area. It usually requires one or two operators to guide the chair down the stairs.

- **Emergency & Exit Lights**

It is a standard requirement in most building codes for multi-story buildings to have electrically wired exit signs and emergency lighting with back-up battery. These lights are designed to work automatically during power outage.

- **Photo-Luminescent (Glow-In-Dark) Evacuation Signage**

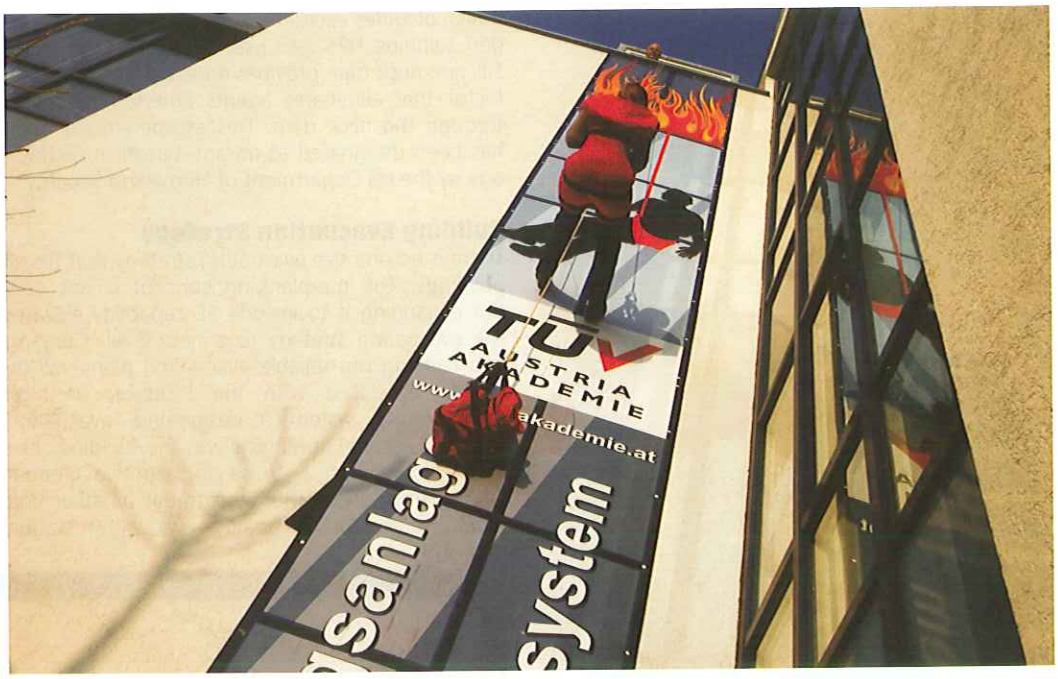
When electricity fails and the electrically wired exit signs and emergency lighting are not functioning, photo-luminescent technology could be the guiding light that leads building evacuees to safety in an emergency. The photo-luminescent components require no electricity since they absorb energy from ambient light and re-emit it when the light is out. The performance of a photo-luminescent component is measured primarily by brightness and the amount of time it produces light, with the light level slowly decreasing over the time.

- **Escape Smoke Hood**

The escape smoke hood is a personal protective equipment that protects a person from smoke inhalation during a fire evacuation. One particular escape smoke hood, the i-Evac, is certified to the American National Standard for smoke hoods ANSI/ISEA 110-2009 and to the NIOSH 42 CFR 84. The unique feature of this smoke/fire hood is that it also provides excellent protection against hydrogen sulphide H2S and uses a silicone neck dam. Silicone neck dam provides an excellent protection factor that eliminates agents entering the hood through the neck dam. This escape smoke hood has been designated as an anti-terrorism technology by the US Department of Homeland Security.

Building Evacuation Strategy

There is no one size evacuation strategy that fits all buildings. The pre-planning concept is not new but expanding it to include SE capability elevates the evacuation strategy to a new level. Creating and carrying out reliable evacuation plans will be greatly enhanced with the inclusion of high technology SE systems at designated "evacuation stations" located strategically in the building. Just as passengers on a cruise ship receive lifeboat assignments, each office, apartment or other unit would receive a designated evacuation station



nearby for use if needed. Failure to develop an exit strategy is a key factor in many large fatality fires.

Localised Rescue and Evacuation

All properties should provide at least one hour's fire protection. The typical high-rise fire is contained to localised areas in the structure. In many cases only the occupants in the fire floor, directly above and next to the source are at immediate risk and in need of attention. They must be evacuated immediately to avoid smoke inhalation that causes so many fatalities. SE pre-plans for that contingency, by locating escape stations on each floor, thereby assuring everyone of timely access.

Shelters in place (SIP)

Many buildings have adopted the safe room and refuge area concept providing occupants with a hardened or protective environment to seek temporary shelter during an emergency. A strategy preferred by some fire departments is to have occupants that are outside the danger zone stay in place and wait to be instructed by arriving responders or designated individuals. Unless there is imminent danger to life or health, SIP may be the best policy. The theory certainly fits well in the SE model, which advises people to avoid the stairs and remain in their space or designated shelter until or unless they have to escape. Such locations are ideal for deploying SE systems.

Total Building Evacuation

In the aftermath of the World Trade Centre attacks in 2001, one of the recommendations from the National Institute of Standards and Technology (NIST) calls for tall buildings to be designed to accommodate timely full-building evacuation of occupants when required in building specific or large scale emergencies, such as widespread power outages, major earthquakes, fires or terrorist attacks. The SE concept anticipates occasional mass evacuations and meets the need with multiple evacuation stations strategically located throughout the structure and close coordination with local responders to conduct rescue operations as needed.

Company Emergency Response Team

Authorities in some countries required designated premises to have in-house "company emergency response team" (CERT). Buildings that have competent personnel in CERT and are well-trained to use SE equipment minimise the risk to lives, property and disruptions to operations. The function of the CERT is to respond immediately to emergencies prior to responder's arrival in an emergency. Time is of the essence in an emergency. CERT not only provides a first line of defence in mitigating incidents, but also timely evacuation of people inside the premises. An important tactical advantage for the CERT is to evacuate people prior to responders' arrival, reducing or eliminating evacuee traffic in the stairwells, leaving them clear for responders' use. With the stairwells clear, responders will be able to gain access to the building more quickly if the fire lift is unavailable, and focus on firefighting and saving the building.

Conclusion

Gone are the days of plans for fire emergencies that may never be used until too late. Today the emphasis is placed on an holistic approach in drawing plans for emergency response that deal with all kinds of emergencies – fire and non-fire related. The making of an emergency response plan (ERP) is an on-going issue requiring genuine cooperation from all willing parties and the plan should also support the concept that no one should be left behind (equal opportunity for evacuation).

The emphasis is also placed on being proactive in ensuring plans are rehearsed with adequate equipment and properly in-house trained personnel – CERT. Supplemental evacuation resources not only conform to the emergency response planning requirements of building owners and/or management in making high-rise evacuation quicker and relatively safer, they also offer a worry-free solution to those people who have difficulty using stairs, giving them the same opportunity as able-bodied people to escape. Just as each building presents its own unique problems, so the provision to each SE solution should reflect those needs. APF

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