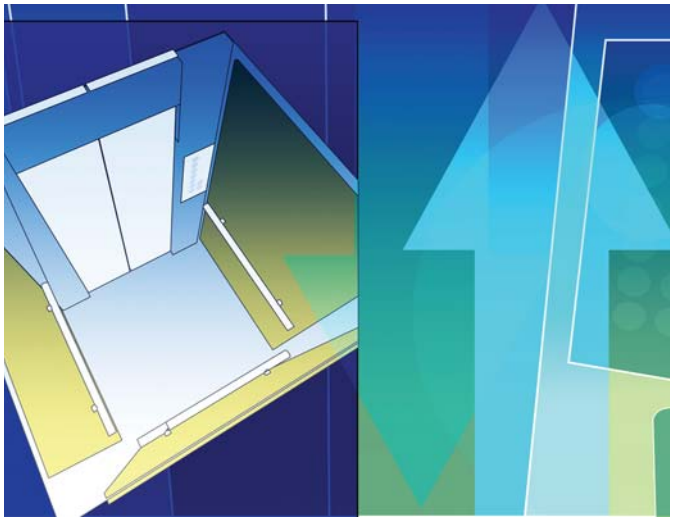
Elevators and Egress

by Beth Tubbs, P.E., ICC Senior Staff Engineer



The use of elevators has historically been prohibited during fire emergencies. However, this philosophy is increasingly being reconsidered—especially for "super" high-rise buildings in which stairs may not be the best evacuation option for occupants with disabilities or debilitating health problems such as asthma or arthritis. Combined with post-9/11 concerns, the unique characteristics of such buildings has shifted the focus solely from phased and partial evacuation to the capability of full building evacuation, making elevators a critical part of the overall emergency egress system. With elevator-assisted evacuation now being allowed in several countries around the world, the subject bears a closer look.

Basic Requirements

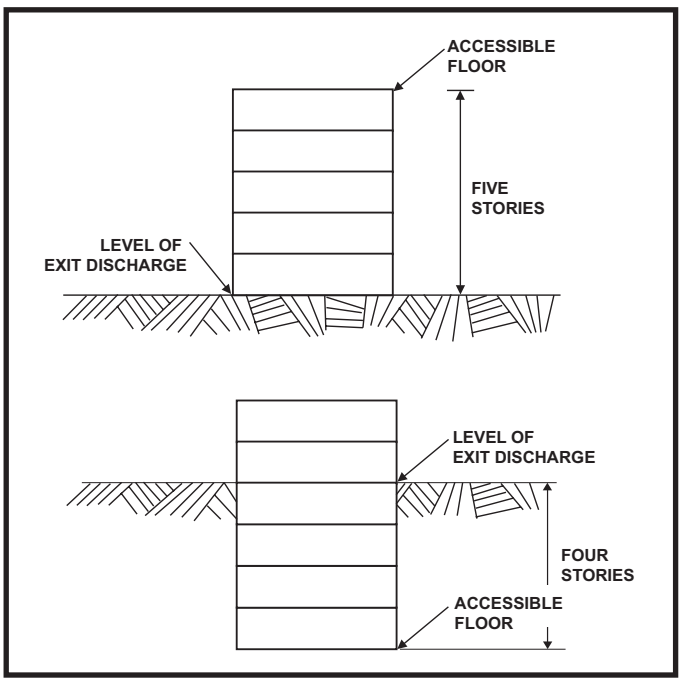
The 2006 *International Building Code* (IBC) does not mandate how or when a building should be evacuated. Rather, it provides requirements for key elements related to safe emergency egress such as sprinklers, exit enclosures, smoke proof enclosures, and alarm and communication systems.

It is important to note that the IBC does not limit the use of available means of egress to fire events or prohibit the use of elevators for evacuation. Nor does it mandate a particular strategy for evacuation. What the code does require is signage at all elevator call stations that reads: "IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS." In high-rise buildings, the code also requires that emergency voice communication systems activate, at a minimum, on the fire floor and the floors directly above and below. Practically speaking, then, the capability of staged evacuation of high-rise buildings is assumed as a minimum, and many of the current prescriptive code requirements reflect that concept. Beyond that, it is a local- and building-specific decision as to how evacuation strategies are established.

In addition, there is a requirement in American Society of Mechanical Engineers (ASME) A17.1, *Safety Code for Elevators and Escalators*—adopted by reference in the IBC—for the capability of a "Phase I" elevator recall, which is essentially an override which relocates elevators to the level of fire department response by manual or automatic means. Thus, even if elevators are specifically promoted for egress, once Phase I recall has been activated by smoke detectors in the elevator lobby, machine room or hoistway or due to activation of the Phase I key switch, they will not be available for general occupant egress.

Accessible Egress

Section 1007 of the 2006 IBC requires the availability of elevators for accessible egress. More specifically, five-story buildings or buildings with four or more stories below the level of exit discharge require an elevator for egress for those with disabilities, with two exceptions: in "Fully sprinklered buildings [. . .] where a horizontal exit is provided and the building story is located at or above the level of exit

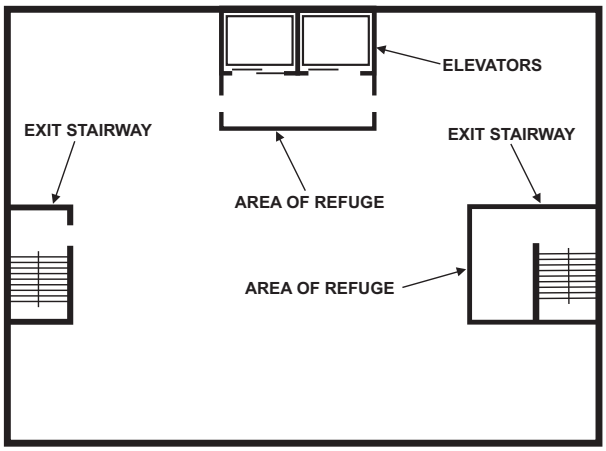


ACCESSIBLE ELEVATOR REQUIRED

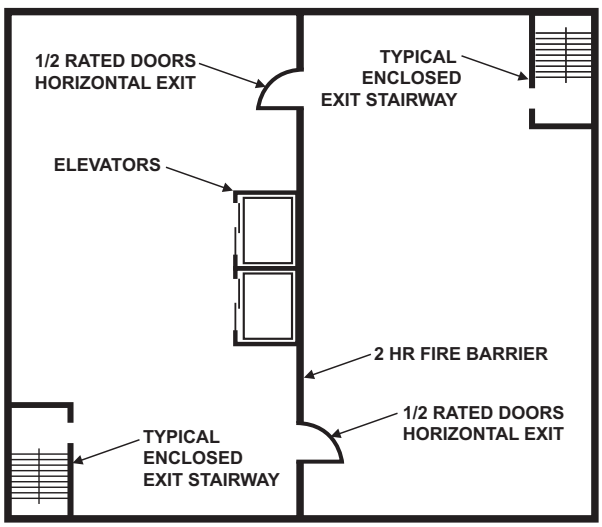
discharge," or "If a ramp is provided in accordance with Section 1010 and the building is sprinklered in accordance with NFPA [National Fire Protection Association] 13 or 13R [. . .]." The first exception was created to reflect the use of a "shelter in place" strategy by hospitals in which the building is divided into smoke compartments via horizontal exits. The second exception was created to accommodate stadiums that employ ramps to achieve elevator-equivalent access for occupants with disabilities.

IBC Section 1007.4 mandates that in order for elevators to be considered part of an accessible means of egress, they must be equipped with standby power and Phase II operation. (Phase II operation is provided by controls built into an elevator that allow fire department personnel to move about the building as needed during an emergency, and therefore facilitates assisted rescue rather than general evacuation.) Thus, the two occupant evacuation strategies prescriptively required by the code are:

1. sheltering in place in an exit enclosure or at an elevator until fire department personnel can assist in rescue, or
2. accessing a horizontal exit that leads away from the initial fire incident.



AREAS OF REFUGE



FULLY SPRINKLERED BUILDING

Stratosphere Tower, Las Vegas, Nevada.

Emerging Alternatives and Ongoing Research

Internationally, and in some cases within the U.S., the use of elevators for egress is becoming more common. The concept of refuge floors is also increasingly being used to more seamlessly accommodate the use of elevators by occupants during emergency situations. The strategy is to have occupants congregate on specific floors via stairs, then evacuate through the use of express elevators. Just such an approach has been employed in the Stratosphere Tower in Las Vegas, Nevada. The single emergency stairwell was considered impractical for emergency evacuation of the 1,149-foot-high structure, so its four high-speed, double-deck elevators were designed for emergency use: one for firefighters and the remaining three for occupants. The evacuation strategy involves removing occupants via stairs to two refuge floors, from which they can evacuate via the elevators.

Although such emergency egress systems are currently much more common outside of this country, a significant amount of research on the subject has been conducted by U.S. building and fire safety professionals. Among the most notable is a 1995 study headed by John H. Klote, D.Sc., P.E., for the National Institute of Standards and Technology (NIST). The group's recommendations for strengthening elevators for emergency egress included:

- earthquake protection,
- provision of an emergency power supply,
- provision of emergency communication systems,
- smoke and heat protection,
- protection against suppression water infiltration,

- resistance to the spread of contaminants and gaseous agents, and
- attention to human factors in management and occupant education/training.

In response to the tragic events of 9/11, ASME organized a conference in March 2004 that focused on the safe use of elevators during emergencies. Recommendations generated by the participants were forwarded to a pair of ASME task groups that include representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. One group was tasked with focusing on occupant evacuation using elevators and the other on the use of elevators by firefighters, and a hazard analysis has been undertaken for each subject.

The analysis of occupant use of elevators is considering possible residual hazards and corrective actions for partial and full building evacuations. Key assumptions of the analysis include the following:

- a new high-rise office building complying with ASME A17.1S-2005 and 2006 model building codes,
- a single fire source,
- provision of a full-coverage smoke detection system per NFPA 72,
- building is fully sprinkled per NFPA 13,
- provision of an emergency voice communication system,
- the absence of a horizontal escape route and stairs and elevators the only vertical movement routes, and
- occupant self-evacuation with elevators prior to automatic (e.g., smoke detector) activation of Phase I recall.

The analysis is not yet complete and conclusions cannot be drawn at this time, but several important considerations have emerged. First and foremost is that the strategy should not be focused solely upon occupants with disabilities but all those who cannot use stairs. Additional considerations when reviewing and applying the results of the analysis should include the likelihood of there being some percentage of "transient" occupants unfamiliar with a particular building as well as the need for adjustments for different occupancies and occupant behaviors.

Although many would like to see more buildings or scenarios addressed in this analysis, it promises to establish a basis for future study and application. From the code perspective, the next step will be for ASME to meet with the ICC Code Technology Committee and the National Institute of Building Sciences Multihazard Mitigation Council to investigate how these issues may be addressed through the codes and standards development processes. ◆

References

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