# Means of Egress

*By Ronald L. Geren, AIA, CSI, CCS, CCCA, SCIP*

In March, the National Institute of Standards and Technology (NIST) released its "Draft Report of the Technical Investigation of The Station Nightclub Fire." If you'll recall, on February 20, 2003, a fire erupted after pyrotechnics ignited stage materials during a concert at The Station nightclub in West Warwick, Rhode Island, resulting in 100 deaths. I used this fire as an example in a previous article on finishes, since the foam insulation was the key element in the rapid spread of fire. However, as significant as finishes are to the control of fire, nothing can contribute more to saving lives than having adequate means of getting people out of a structure during emergencies. Unfortunately, The Station nightclub fire is a good example of how poor exit design can lead to tragic results.

History is strewn with other fire and emergency events with significant loss of life as a result of inadequate exit capacity, blocked exits, and overall poor exit planning. Some of these events had an impact on code development by introducing significant changes. Most notable is the Triangle Shirtwaist Company fire in 1911. This factory fire killed 147 in a 10-story loft building in New York City. The public outrage that followed the fire spawned numerous committees that evaluated life safety which eventually led to the first edition of the National Fire Protection Association's (NFPA) *Building Exits Code* in 1927, the precursor to the *Life Safety Code*.

Means of egress covers a large, and sometimes complicated, portion of building code regulations. Because of that, I won't attempt to get into the details of calculating exit width, occupant loads, et cetera. Instead, I'll focus primarily on the major components of the means of egress system and how they interface with each other. I'll also cover some basic egress terminology used by the codes.

In the United States today, there are essentially four available documents that regulate the means of egress. These documents consist of the following:

- The International Building Code (IBC)
- NFPA 5000, Building Construction and Safety Code
- NFPA 101, Life Safety Code
- OSHA 1910 Subpart E, Exit Routes, Emergency Action Plans, and Fire Prevention Plans

The IBC has replaced the three national model building codes that existed prior to 2000, and the NFPA 5000 is the NFPA's version of a model building code, which has received very little acceptance to date. On the other hand, NFPA 101 is widely used and referenced. The OSHA regulation, originally based on the 1970 edition of the *Life Safety Code*, is limited in scope in that it applies only to the workplace environment. It also provides requirements beyond those listed in the other three documents, such as emergency action and fire prevention plans. Because of its close ties to the *Life Safety Code*, OSHA states that compliance with NFPA 101, 2000 edition, will be deemed in compliance with applicable portions of the OSHA regulation.

Other documents also address means of egress, but integrate or reference the means of egress requirements of their associated building or companion codes. The NFPA 101 has a companion code, the NFPA 101B, which provides a stand-alone document that can be used by jurisdictions that want to replace the means of egress chapter within the locally adopted building code; a common method among federal agencies. The *International Fire Code* incorporates portions of the means of egress chapter in the IBC, and is maintained by an IBC committee.

"Means of egress," as defined by the IBC, is "a continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way." It further defines the means of egress system as consisting of three "separate and distinct" parts, each of which will be discussed in detail later. This 3-part structure, or zonal approach, was first developed by the NFPA in 1956. It was later adopted for use over time by the three existing model building codes, with the *Uniform Building Code* being the last to incorporate it in the 1997 edition. The three parts consist of:

- The exit access
- The exit
- The exit discharge

The **exit access** is defined as "that portion of a means of egress system that leads from any occupied portion of a building or structure to an exit." Typically, this would be the route you'd take from your desk to either an exterior door (either at grade level, or to an exterior stair or ramp) or a protected exit enclosure, such as an enclosed stairway. This route may consist of doors, unenclosed interior stairs, corridors (fire-resistive or not), interior ramps, intervening rooms, aisles, and exterior balconies.

Those of you familiar with the 1997 UBC will notice the absence of hallways from the list of exit access components. What were considered hallways in the UBC are now considered corridors in the IBC. Now, before you start hyperventilating, you need to understand that corridors in the IBC may be of non fire-resistive construction depending on occupant load served or the installation of a sprinkler system throughout the building. Even this varies depending on the building's occupancy (i.e. residential, business, hazardous, etc.). The positive side of this is that non fire-resistive corridors (formerly hallways) are not considered intervening rooms as was required in the 1997 UBC.

The allowable travel distance within the exit access cannot exceed the distances listed in Table 1015.1 of the IBC, and, in most cases, will be limited to 200 feet. If a sprinkler system is installed throughout the building, these distances may be extended by as much as 50% depending on the occupancy. However, the total allowable travel distance cannot be a single, one-way path; this is referred to in the IBC as a "common path of egress travel." At some point, the occupant must have a choice of at least two separate paths that lead to at least two separate exits. With the exclusion of some hazardous occupancies and other listed exceptions, this distance is limited to 75 feet.

The **exit** is defined, in part, as "that portion of a means of egress system which is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives as required to provide a protected path of egress travel…" Components of the exit include doors at grade level, interior enclosed stairs and ramps, exterior stairs and ramps, horizontal exits and exit passageways. Some exit components, such as stairway enclosures and exit passageways, require fire-resistive protection of 1 or 2 hours.

An exit component that is seldom understood, and probably under-utilized, is the horizontal exit. The horizontal exit allows occupants to "exit" from one side of the building to another through a fire wall or fire barrier without actually having to leave the building, thereby dividing the building into "refuge areas." These are extremely beneficial in hospital occupancies where it is difficult to move patients vertically. Horizontal exits could be a cost saving option to the design team by replacing a required exit that would typically be served by a stairway. For example, if a floor's occupant load requires three exits, a horizontal exit can be installed as the third exit, thereby requiring only the minimum two stairways from that floor. A few things to keep in mind about horizontal exits are that they must extend through all floors unless the floors have a 2-hour fire-resistance rating, there are no unprotected openings between refuge areas, and no more than 50% of the required exits are horizontal exits.

Lastly, the **exit discharge** is defined as "that portion of a means of egress system between the termination of an exit and a public way." The exit discharge must be directly to the exterior at grade, or it must provide a direct path to grade. But just getting to the outside at grade level doesn't complete the exit discharge, you must get to the public way, which is defined as "a street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use." Components of the exit discharge may include stairs, ramps, doors, gates, and turnstiles, and must comply with all requirements for maintaining egress width, illumination, accessibility, and continuity.

However, there are a few exceptions which allow vestibules and lobbies within the exit discharge. To qualify, they have to be separated from the floors below by a fire-resistance rating equal to the exit enclosure. Additionally, lobbies must be separated from other areas of the same level by a fire-resistance rating equal to the exit enclosure, or provide a sprinkler system in all areas with access to the lobby. No more than 50% of the exits can discharge through a vestibule or exit discharge lobby.

A discussion on means of egress would not be complete without mentioning two other key egress planning requirements: exit capacity and exit separation.

Exit capacity is essentially the number of occupants that the exit path can safely and efficiently handle. The code establishes minimum widths for exit components such as doors and stairs, but these minimums can only manage a limited number of occupants before the rate of egress is slowed down or completely stopped. Therefore, exit components must be sized to accommodate the design occupant load as determined by the codes through established occupant load factors (square feet per person) based on the proposed use of a space. For example, restaurant dining rooms would have a higher number of occupants per floor area than an open office area.

In cases where the code requires two or more exits, the exits must be adequately separated from each other. This is to prevent the exits from being blocked by the same obstruction (fire, fallen debris, etc.) during an emergency. The "1/2 Diagonal Rule" has been in the codes for a long time, and basically states that the separation between at least two exits can be no less than 1/2 the greatest diagonal of the building. For example, a building that is 60 feet wide and 90 feet deep has a maximum diagonal length of about 108 feet; therefore, the separation between at least two required exits can be no less than 54 feet. The IBC, however, permits this separation to be reduced to 1/3 the diagonal in buildings sprinklered throughout.

In this article, we've only skimmed the surface on means of egress. Exiting is a very important part of the building code, and, a very complex one, as well. To give you an idea of its complexity, the means of egress chapter of the IBC (Chapter 10) is 31 pages long, but the *IBC Commentary* takes 137 pages to explain it! Complexity can lead to misinterpretation, and misinterpretation can lead to improper design and/or enforcement – a potentially dangerous situation. However, this can be overcome by learning and understanding the details of egress design in accordance with the codes. Both the International Code Council (ICC) and NFPA have seminars and reference materials that specifically address means of egress requirements.

During NIST's investigation, many code violations were discovered; each was categorized by probability of impact on the loss of life had the building complied with the codes. Included in the report summary are recommendations such as increasing the main exit width of assembly buildings from 1/2 the total required width to 2/3, and eliminating some fire sprinkler trade-offs that affect egress. Code development is an ongoing process fueled by past tragedies, such as The Station fire. Perhaps some formal changes will be introduced to the codes as a result of NIST's report on The Station fire. But, discovering the mistakes after-the-fact doesn't justify improper application of the requirements before-the-fact.

Note: You can view the full NIST report at http://www.nist.gov/public_affairs/ncst.htm.

*To comment on this article, suggest other topics, or submit a question regarding codes, contact the author at ron@specsandcodes.com.*

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