The Code Corner

RLGA Technical Services

No. 30 — Winter 2010

Stages and Platforms

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It was a cold afternoon on December 30, 1903, in Chicago. Almost 2,000 patrons, mostly women and children, were crammed into the five-week-old Iroquois Theatre, which was designed to seat slightly fewer than 1,700. The difference in the occupancy was made up by patrons holding standing-room-only tickets, which were commonly issued during that period. Suspended in the fly gallery above the stage were scenery flats—thousands of square feet of painted fabric. Located in close proximity to the scenery were electric arc spotlights that were illuminated for the matinee showing of Mr. Bluebeard.

Sometime late in the second act, one of the spotlights sparked, igniting the adjacent scenery. The fire spread through the fly gallery as flaming debris fell to the stage. Panic ensued and performers and patrons began to run for the exits. The asbestos "fire curtain" at the proscenium was lowered, but became snagged on a light reflector, preventing its full closure.

A door off the side of the stage was opened as the performers exited, allowing cold air to rush in. Since the stage vents were secured from opening, the burst of cold air generated a fireball that blew past the stuck curtain into the house seating, seeking escape through the ventilation provided in the rear wall at the uppermost balcony level. The fireball ignited everything flammable in its path as it rose—primarily in the upper levels—consuming the air that was up there and asphyxiating most patrons who weren't lucky enough to escape.

Within 15 minutes of ignition, the fire essentially burned out by itself, and all was quiet in the theater.

The theater structure—billed as "Absolutely Fireproof" in the show's program—remained intact. However, a total of 602 lives were lost, mostly due to the inadequacy of the theater's egress system. It remained the deadliest single building fire in American history until the events of September 11, 2001[†].

Although the egress system of the Iroquois Theatre was wholly ineffective to handle the volume of patrons attending that day, it is undisputable that many of the casualties would have survived if the stage area was designed with sprinkler protection, and if installed safety equipment were functioning properly. Quoted in the *New York Times* shortly after the fire, then mayor of Chicago, Carter H. Harrison, said,

> ...the fact remains, and it cannot be denied, that there would have been no panic if the apparatus in this theatre, which, judged by all ordinary standards, was the best equipped playhouse in the city, had been in proper working condition. There is no getting beyond that fact.

Building Code Requirements

Several of the theater-related building code requirements in effect at the time of the Iroquois fire are similar to those in the *International Building Code* (IBC)[‡]. Since many of the historic theater fires have started within the stage area (like the Iroquois'), building codes have focused on the regulation of combustible materials, the suppression of fire, and the containment of fire to the stage area, in addition to means of egress.

[†] The north building of the World Trade Center had an estimated 1,366 deaths and the south building had 618 deaths, excluding passengers of the planes that struck the buildings.

[‡] The 2009 IBC, Second Printing, is used in the preparation of this article.

Due to their similarities, the individual requirements for stages and platforms are both found in a single section of Chapter 4 in the IBC. Although providing similar functions, stages and platforms in the IBC are clearly defined in order to highlight their differences. The significant difference between a stage and a platform is that stages have "overhead hanging curtains, drops, or scenery or stage effects other than lighting and sound," whereas these are absent from platforms. As demonstrated in the Iroquois Theatre tragedy, overhead scenery and other combustibles increase the fire hazard; thus, stages are subject to more restrictive requirements.

Common to both stages and platforms are the superstructures located above them for access, supporting lighting, scenery, and other equipment. Called gridirons, pinrails, and catwalks, these structures shall be fabricated of materials consistent with the building's type of construction, but are not required to have a fire-resistance rating. Also, since they are designed for human access in most cases, these structures are not to be considered as floors, stories, mezzanines, or levels.

Platforms

There are two types of platforms: permanent and temporary. Temporary platforms are those erected for a short period of time not to exceed 30 days. Platforms are generally used to raise the performance or speaker area to an elevation that allows better viewing by patrons, but does not involve complex scenery or have curtains.

Permanent platforms are permitted to be constructed of materials required for the type of construction of the building. However, in Type I, II, and IV buildings, fire-retardant-treated wood may be used for platforms complying with the following:

- The platform is not higher than 30 inches above the main floor;
- The platform is no more than 1/3 of the room floor area; and,
- The platform is not more than 3,000 sq. ft. in area.

If the space below the platform is used for storage or any use other than equipment, wiring, or plumbing, the floor construction of the platform shall be not less than one-hour fire-resistive construction, regardless of the building construction type.

Temporary platforms may be constructed of any materials permitted by the IBC. However, the space under the platform can only be used for wiring and plumbing connected to platform equipment—storage or any other use is not permitted.

Stages

Unlike platforms, stages have unique characteristics that give them a higher risk for fire. As the definition indicates, stages utilize scenery drops, curtains, and other combustibles that are stored in an overhead space above the stage that is defined in the

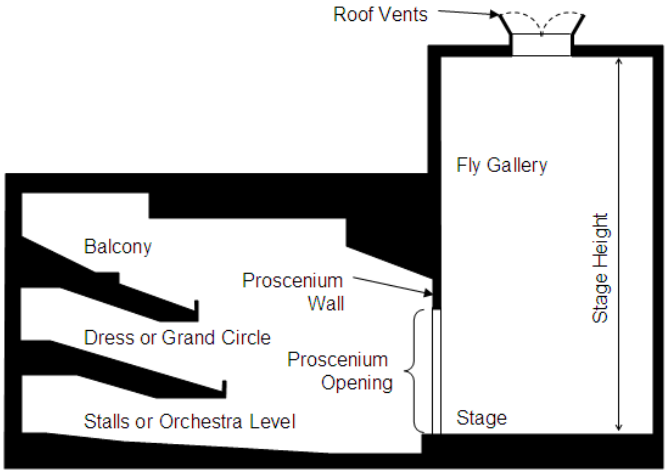

Figure 1 - Typical Theater Cross-Section

IBC as the "fly gallery," but is also referred to in the industry as the "fly tower" or "fly loft." This overhead space could be extremely high—at least 2 to 2-1/2 times the height of the proscenium, which is the opening between the stage and the seating area. The measurement between the lowest stage surface and the highest point of the roof or floor deck of the fly gallery is considered the "stage height" and it has code compliance implications.

The size of the stage in terms of floor area also has code compliance implications. When the IBC refers to the floor area of a stage, it includes the entire performance area and any backstage and support areas not separated from the performance area by fire-resistance-rated construction. Therefore, this area can be much larger than just the visible performance area.

The construction of the stage itself varies with a building's construction type. In Type IIB and IV construction, stages may be constructed of 2-inch wood decking provided the proscenium wall has a 2-hour fire-resistance rating. In Type IIA, IIIA, and VA construction, a fire-resistance-rated floor assembly is not required as long as the space below the stage is protected by an automatic sprinkler system or an alternative automatic fire-extinguishing system. In all types of construction, the finished floor of the stage may be of wood or other approved noncombustible materials.

One of the requirements based on stage height is the fire-resistance rating of the proscenium wall. If the stage height exceeds 50 feet, the proscenium wall must have a 2-hour fire-resistance rating and must extend from the foundation to the roof. When the proscenium is required to have a fire-resistance rating, the proscenium curtain shall comply with NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, or provide a water curtain complying with NFPA 13, *Installation of Sprinkler Systems*, or a smoke control system complying with IBC Section 909. The smoke control system option is only permitted if the assembly seating *is not* smoke-protected.

Whether the proscenium wall is required to be protected or not, the stage is still required to be separated from dressing rooms, workshops, storerooms, and other spaces accessory to the stage by fire barriers and horizontal assemblies. If the proscenium is not required to be fire-resistance rated, then the required separation need only be 1 hour; if the proscenium is required to be rated, then a 2-hour separation is required. Additionally, these spaces are required to be separated from each other with fire barriers or horizontal assemblies having a 1-hour fire-resistance rating.

To prevent fires from spreading quickly on the stage and in the fly gallery, as experienced in the Iroquois Theatre, the scenery used must comply with the requirements of NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, and with Section 806 of the *International Fire Code* (IFC) for decorative vegetation. Foam plastics used in scenery are required to comply with the requirements of IFC Section 2603.

When a stage has an area greater than 1,000 sq. ft. or a height greater than 50 feet, then one of the following must be provided:

- Two or more roof vents having an aggregate area that is at least 5% of the stage area. The vents are to be located near the center above the highest point of the stage. Operation of the vents shall be heat-activated (typically by fusible links), as well as manually.
- A smoke control system complying with IBC Section 909 that will maintain a smoke layer not less than 6 feet above the highest seating level in the auditorium or above the top of the proscenium opening when the proscenium has a 2-hour fire-resistance rating.

Means of egress from a stage shall be provided by two exits—one on each side of the stage and one on each side of the space under the stage. Furthermore, exterior doors located on the stage that are required for means of egress or may otherwise be opened when the theater is occupied, must be provided with a vestibule. This is to prevent sudden drafts of air into the theater—similar to the rush of air that sent the massive fireball into the upper levels at the Iroquois Theatre. Fly galleries and gridirons shall also be provided with at least one means of escape, and may utilize steel ladders, alternating tread devices, or spiral stairways that egress to the stage roof.

Stages are required to have an automatic sprinkler system, which was so tragically missing from the Iroquois Theatre. This is required whether or not the rest of the theater is required to be sprinklered per IBC Section 903.2.1.1. The only exception is for stages that have an area 1,000 sq. ft. or less, or a height 50 feet or less, *and* that do not have curtains, scenery, or other combustible hangings that are retracted vertically. Sprinklers are also not required in areas under the stage that are less than 4 feet clear in height, used only for storage of tables and chairs, and are separated from adjacent areas with 5/8-inch-thick Type X gypsum board.

For stage areas greater than 1,000 sq. ft., a Class III wet standpipe shall be provided on both sides of the stage, each with 1-1/2-inch and 2-1/2-inch hose connections. However, if a sprinkler system is required in the building or fire area, then only 1-1/2-inch hose connections are required, and they may utilize the same standpipe required for the NFPA 13 sprinkler system. Additionally, a Class II or III standpipe installed in accordance with NFPA 14, *Standard for the Installation of Standpipes and Hose Systems*, may be used instead of the other systems described.

The Chicago building code in effect in 1903—*An Ordinance relating to the Department of Building and Governing the Erection of Buildings, Etc. in the City of Chicago*—incorporated requirements that exhibit a comprehensive understanding of the fire threat in theaters for that period of time. However, even the most comprehensive and technically advanced building code will not prevent a disaster if owners and designers do not comply with code requirements, and if building departments do not enforce them, which was the situation with the Iroquois Theatre—a lesson that was learned too late.

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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Suggested Reading:

Brandt, Nat. *Chicago Death Trap: The Iroquois Theatre Fire of 1903*. New York: Southern Illinois University, 2006. Print.