

**BCMC REPORT ON STAGES, PLATFORMS AND SOUND STAGES
 NOTICE OF A PUBLIC HEARING
 MAY 5, 1992 AT THE DAYS INN INNER HARBOR, BALTIMORE, MARYLAND
 WITH DRAFT COMMENTARY**

The Council of American Building Officials' Board for the Coordination of the Model Codes considered stages and platforms and issued recommendations in the BCMC Report dated July 16, 1980.

At the request of members of the industry, including representatives of the American Society of Theater Consultants, CABO approved the reconsideration of the earlier recommendations. The content of this report was developed at the 61st, 62nd, 63rd, and 64th meetings of the BCMC based on the 1980 Report.

1.0 **Scope:** Stages, platforms, sound stages and accessory spaces shall conform with the requirements of this section.

The requirements herein apply to these spaces in all occupancies.

2.0 **Definitions:** For the purpose of this section, certain terms are defined as follows:

FLY GALLERY is a raised floor area above a stage from which the movement of scenery and operation of other stage effects are controlled.

GRIDIRON is the structural framing over a stage supporting equipment for hanging or flying scenery and other stage effects.

PINRAIL is a rail on or above a stage through which belaying pins are inserted and to which lines are fastened.

PLATFORM is an area within a building used for entertainment or presentation wherein there are limited combustible materials or finishes.

PROSCENIUM WALL is the wall that separates the stage from the auditorium or house.

STAGE is a space within a building used for entertainment or presentations. Stage area shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the stage by fire-resistance rated construction. Stage height shall be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the stage.

3.0 **Loads:** The design of platforms and stages shall comply with the requirements of Chapter ____ (Structural). Provisions shall be made for the loads for the following:

3.1 Minimum uniformly distributed live loads:

Stages and platforms	125 psf
Catwalks	40 psf
Followspot, projection and control rooms	50 psf
Head beams	
Loft beams	
Gridiron, walk-on	
Loading and fly galleries	
Railings, channels or similar battens intended for mounting theatrical lighting	
Pinrails and locking rails	

3.2 All structural members and connections shall be designed to prevent overstressing of those components. All such assumed loads shall be clearly noted on construction documents submitted for approval.

The issue of design loads was considered at length. Without sufficient documentation and research, the Board chose not to include specific values for the loads resulting from stage equipment.

The Board encourages the entertainment industry to develop a national consensus standard with appropriate values and/or criteria for calculating values for the design of the structural framing of stages. This standard may then be referenced by the building codes. The design standard should include the magnitude and direction of all stage equipment loads necessary for the structural design. While not appropriate for building codes, theatre owners may find it beneficial to post these loads. The New York City code may serve as a model: "A plan drawn to a scale not less than one-quarter inch equals one foot shall be displayed in the stage area indicating the framing plan of the rigging loft and the design loads for all members used to support scenery or rigging."

4.0 **Platforms:**

4.1 Platforms shall be constructed of materials as required for the type of construction of the building in which the platform is located except that the finish floor may be of wood in all types of construction. Where the space beneath the raised platform is used for storage or any other purpose other than plumbing and electrical wiring, the floor construction shall not be less than one-hour fire-resistive construction.

4.2 Platforms installed for a period of not more than 30 days may be constructed of any materials permitted by the code. The space between the floor and the platform above shall only be used for

plumbing and electrical wiring to platform equipment.

These requirements address any area intended to be used for presentation or entertainment without combustible materials, such as combustible decorations, scenery or scenic elements, exceeding the level otherwise permitted by the building code. Lecture rooms, meeting rooms, classrooms, altars in churches, sports venues, studio theatres, etc., are typical of this type of space. Where concealed space is created as a result of a raised platform, extra precautions are necessary because of the likelihood of fire originating in the area under platforms as shown by fire records.

5.0 Stages:

5.1 The minimum type of construction for stages shall be as required for the building as determined by the occupancy, area, and height except that the finish floor may be of wood in all types of construction.

5.1.1 All portions of a stage area with a stage height greater than 50 feet shall be within an area separated from all other building areas by 2 hour fire-resistance rated construction with protected openings except that the main opening in the proscenium wall used for viewing performances shall be provided with proscenium opening protection. The 2 hour fire-resistance rated construction shall extend to the roof or floor deck above the auditorium.

5.1.2 Where permitted by the building construction type or where the stage is separated from all other areas as required in 5.1.1 above, the stage floor may be of unprotected noncombustible or heavy timber framing members with a minimum 1½ inch thick wood deck.

This paragraph permits traps and stage lifts in the stage floor. The room or space below the stage into which the traps or lifts open shall be separated as in 5.1.1. Fire prevention codes should require that such room or space should not be used as a workshop or storage area except that scenery or scenic elements used for a current production are permitted.

5.1.3 Where a stage floor is required to be one hour fire-resistance rated, the stage floor may be unprotected when the space below the stage is sprinklered throughout.

5.1.4 Where the stage height is 50 feet or less, the stage area shall be separated from accessory spaces by 1 hour fire resistance rated construction with protected openings.

Exception: Control rooms and follow spot rooms may be open to the audience.

5.2 **Accessory rooms:** Dressing rooms, workshops, store rooms and other accessory spaces contiguous to stages shall be separated from each other and other building areas by 1 hour fire resistance rated construction and protected openings.

5.3 **Ventilators:** Emergency ventilation shall be provided for stage areas greater than 1000 square feet or with a stage height of greater than 50 feet to provide a means of removing smoke and combustion gases directly to the outside in the event of a fire. Ventilation shall be by one or a combination of the following methods:

5.3.1 **Smoke control:** A means shall be provided to maintain the smoke level not less than 6 feet above the highest level of assembly seating or above the top of the proscenium opening where a proscenium wall and opening protection is provided. The system shall be activated independently by each of the following; (1) Activation of the sprinkler system in the stage area (2) by manually operated switch at an approved location. The emergency ventilation system shall be connected to both normal and standby power. The fan(s) power wiring and ducts shall be located and properly protected to assure a minimum 20 minutes of operation in the event of activation.

5.3.2 **Roof vents:** Two or more vents shall be located near the center of and above the highest part of the stage area. They shall be raised above the roof and provide a net free vent area equal to 5 percent of the stage area. Vents shall be constructed to open automatically by approved heat-activated devices. Supplemental means shall be provided for manual operation of the ventilator from the stage floor. Vents shall be labeled by an approved agency.

Means and procedures for periodic testing and maintenance of this equipment should be included in the operation of the building.

5.4.3 The proscenium opening shall be protected by an approved fire curtain or an approved water curtain complying with NFPA 13 (4-4.2.1). The fire curtain shall be designed to close automatically upon automatic detection of a fire and upon manual activation and shall resist the passage of flame and smoke for 20 minutes between the stage area and the audience area.

The concept of separating the stage (assumed to be the most likely area for a fire to originate) from the audience within a single occupancy was discussed at length. While some testimony dwelled on prevention of panic as a result of occupants seeing the effects of a fire, there was not documentation to support this. To the contrary, contemporary research on behavioral response to fire and smoke indicates this is not a problem. There is no evidence of non-adaptive behavior reducing the escape possibilities or causing injury.

The fire curtain may function as a smoke barrier if it closes. Therefore, utilizing the deluge system in lieu of a fire curtain places more reliance on the smoke control or roof vents to maintain smoke protected means of egress for the egress time.

There were no records of civilian deaths or injuries resulting from a fire in a theatre in recent history presented. (This is roughly since the use of the electric light became commonplace early in this century.) There were several cases of major loss of property in theatres, all in Europe, and all in non-sprinklered stages as is common in Europe.

Testimony was presented indicating that a large proportion of fire curtains, somewhere between 50 and 95 percent, are not properly installed or are not properly maintained and are not fully operative. The Board encourages the entertainment industry to develop a performance standard with appropriate requirements for the design, installation, testing, inspection, and reliable operation of fire curtains.

- 5.5 **Gridiron, fly galleries and pinrails:** Beams designed only for the attachment of portable or fixed theater equipment, gridirons, galleries and catwalks shall be constructed of materials consistent with the building type of construction and a fire-resistance rating is not required.

This paragraph recognizes that the normal use and operation of a stage requires that stage equipment, nominally rigging, be installed and rearranged as production requirements vary. This equipment is normally installed by clamping and/or welding to the structural framing over and around the stage, making protecting the framing by encasement or membranes unfeasible. It will often be the case that this structural framing is sufficiently high above the stage floor that it may be unprotected.

Exception: Combustible materials shall be permitted for use as the floors of galleries and catwalks of all types of construction.

This provision permits the use of wood to be used as the decking for these spaces which are generally limited in area and where access is restricted to authorized personnel.

- 5.6 **Means of egress:** The minimum occupant load of stages and platforms shall be based on 1 person per 15 sq. ft. Where two means of egress are required, they shall be separate with at least one means of egress on each side.

- 5.6.1 The means of egress from lighting and access catwalks, galleries and gridirons shall meet the requirements for industrial occupancies.

Exception 1: A minimum of 22 inches shall be permitted for lighting and access catwalks.

Exception 2: A second means of egress is not required from these areas when a means of escape to a floor or to a roof is provided. Ladders, alternating tread stairs, or spiral stairs shall be permitted in the means of escape. Each tier of dressing rooms shall be provided with two exits meeting the requirements of the Exit Chapter.

- 5.6.2 Stairways required by this subsection need not be enclosed.

Plans submitted for review don't allow for the varying arrangements of scenery and scenic elements. Owners and users are urged to exercise special caution in maintaining these minimum means of egress requirements as the arrangement of scenery and scenic elements vary.

- 5.7 **Guardrails:** Where the side of an elevated walking surface is required to be open for the normal functioning of special lighting or for access and use of other special equipment, a graspable rail shall be provided which is not less than 34" nor more than 42" above the walking surface. A temporary intermediate barrier shall be provided where access for the special equipment is not required.

This permits the common practice of open-sided lighting catwalks and platforms over and surrounding stages and platforms. Significantly, this adds a requirement for the provision of a temporary guard to be used when the area is used other than lighting or equipment access. For instance, catwalks which may be used for lighting only some of the time but are serve as a means of egress (from other catwalks typically) should be provided with this temporary guard. Loading bridges and locking rails back stage are also typical of areas where these alternate guard rail requirements apply.

- 5.8 Guardrails are not required on the audience side of stages, raised platforms, and other raised floor areas such as runways, ramps and side stages used for entertainment or presentations.

- 5.9 Permanent guardrails are not required at vertical openings in the performance area of stages.

- 6.0 **Flame retardant requirements:** Combustible scenery of cloth, film, vegetation (dry), and similar effects shall meet the requirements of the Fire Code. Foam plastics shall have a maximum heat release rate of 100 kW when tested in accordance with UL 1975.

Typically, curtains and backdrops are the extent of these items which might be included in the plans submitted for review. These materials should not generate smoke more dense than that given off by untreated wood or paper burning under comparable conditions when tested in the vertical flame test in accordance with NFPA 701, Standard Methods of Fire Tests for Flame-Resistant Textiles and Films. These materials may also be subjected to a field test in accordance with chapter 6 of NFPA 701. Most fabricators of curtains and drops affix a certification label, sewn on back of each curtain or drop at bottom of the hem, indicating treatment, testing, and the warranted period of effectiveness (usually 5 years).

7.0 **Automatic Sprinklers in Stages:** All stages shall be sprinklered. Such sprinklers shall be provided throughout the stage and in dressing rooms, workshops, storerooms, and other accessory spaces contiguous to such stages.

Exceptions:

1. Sprinklers are not required for stages 1000 square feet or less in area and 50 feet or less in height where curtains, scenery, or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs, and a single backdrop.

2. Under stage areas less than 4 feet in clear height used exclusively for chair or table storage and lined on the inside with 5/8 inch Type X gypsum wallboard or the approved equal.

7.1 **Standpipes:** All stages greater than 1000 square feet in area shall be equipped with a Class III standpipe located on each side of the stage.

8.0 **Sound Stages:** All buildings or portions thereof used for the specific purpose of sound stages for motion picture or television productions and greater than 1000 sq. ft. shall be protected with an approved automatic sprinkler system.

At the 63rd meeting the BCMC established the following facilities in concept:

- A. A platform with limited hangings would comply with the building requirements including protection methods as it simulates a floor area of the building.
- B. A stage with an area (includes all performance areas and adjacent areas not separated by 1 hour fire-resistance rated assembly from the stage area) of less than 1000 square feet and less than 50 feet in height (stage floor to roof/floor deck above) is to be sprinklered, including all accessory spaces. Sprinklers are not required where hangings are limited and are not vertically retractable.

This is the typical small school, church, or community center stage, often a part of a multi-purpose room, gymnasium, or cafeteria. In some instances, a small "experimental" or studio theatre may fit in this category. Previous to this report, this would have either been a platform or a regular stage exempted from sprinklers because of the limited size and limited area for combustible scenery and scenic elements.

- C. A stage with an area of more than 1000 square feet and less than 50 feet in height shall have sprinklers throughout, including all accessory and performance areas. Ventilation is to be provided in all areas not separated from the stage area by a 1 hour fire-resistance rated assembly.

This stage is most often found in the medium size public school or small college theatre or is the second or third theatre in a performing arts center. It includes all forms of theatres - end stage, thrust, arena, cabaret, flexible, black box, etc. - where the use of scenery and scenic elements is expected but in which the stage equipment does not readily permit multiple settings with large quantities of combustible scenery, scenic elements, and like decorations. Suppression systems are proven very effective in this limited height situation.

- D. All stages with a height at any point of more than 50 feet are to be sprinklered throughout all areas. Ventilation is to be provided in all areas not separated from the stage areas by a 2 hour fire-resistance rated assembly. A proscenium wall and opening protection is to be provided for the stage areas with a height of more than 50 feet. All accessory areas are to be separated from the stage by a 2 hour fire-resistance rated assembly.

This stage is the traditional large theatre with full working stage. It is typical of the large high school theatre, medium to large college and university theatre, the regional performing arts center, and the professional or "broadway" theatre or road house venue. The height of the stage and the stage equipment permits multiple settings and large amounts of scenery and scenic elements in dense configurations. The height may reduce the effectiveness of suppression systems and the multiple settings hung over the stage may further obstruct the suppression systems and impede access to a fire originating high above the stage.

- E. Exhibition halls, arenas, and coliseums are to be sprinklered throughout with smoke protected assembly seating.

Increasingly, live entertainment is being produced for these buildings, complete with large amounts of scenery and scenic elements. Stages in these spaces are usually temporary as required by the multi-event use of the space. The stage area cannot be compartmented or otherwise separated by fire-resistant construction from the other areas of the building.

It is conceivable to have a stage that combines the categories above such as a main stage area (category D) with a thrust stage (category C).

A full working stage with a stage height greater than 50 feet (Type D) with the lower (Type B or C) stage area extending into the audience side of the proscenium wall is probably the most typical example of this "combination". The stage area for determining sprinkler and ventilation provisions is the aggregate of the type D and C stage areas. The greater than 50 feet high space would be within an area separated by 2 hour construction from other building areas; the type C area may also be within the 2 hour separation or outside of it, i.e.: on the audience side of the proscenium wall.

At the 64th meeting, a matrix (shown below) of the provisions as determined at the 63rd meeting, was presented. The provisions were comprehensively revised as indicated herein to reflect the above matrix.

STAGE FACILITIES					
Type Feature	A	B	C	D	E
Height	No limit	< 50 feet	< 50 feet	> 50 feet	No limit
Area	No limit	< 1000 sq.ft.	> 1000 sq.ft.	No limit	No limit
Contents	As for occupancy	No limit	No limit	No limit	No limit
Constr. & Compart.	Per occupancy No reqmnt.	1 hour separation	1 hour separation	2 hour separation Proscenium & Curtain	No requirement
Suppression	Per occupancy No reqmnt.	Stages & ACC. Areas Exception limited - not retractable	Stages and accessory areas	Stages and accessory areas	Stages and accessory areas or building
Vent	Per occupancy No reqmt.	Per occupancy No reqmt.	Ventilation required	Ventilation required	Ventilation smoke protected seating
Standpipes			Required	Required	Required