Code Review for Theaters and Props

Fire- and Life-Safety Group (FLS)

I. INTRODUCTION


II. EXECUTIVE SUMMARY

Based on the relevant code sections, which are shown in Section III of this document, the following general requirements were found for each area or task of the theater:

A. Stages are to be sprinklered and be constructed of materials that are consistent with the rest of the building construction. Please see Section III.A for the applicable code sections.

B. Scenery that is used in theater productions is to be made of the least combustible material possible. Any props that pass the proscenium opening are to be constructed of noncombustible material, limited-combustible material, or of fire-retardant-treated wood. Additionally, FLS suggests that any scenery or props made of combustible materials be treated with appropriate fire retardant chemicals. Please see Section III.B for the applicable code sections.

C. Structures that are used in theater productions are to be considered interior finishes and are not to be considered decorations or furniture. The structures are to meet the required flame spread or smoke development classification that is shown in Section III.C.

D. Platforms are to be constructed with the same type of construction as the building unless they are temporary platforms, which can be constructed of any material allowed by the building and fire codes. Please see Section III.D for the applicable code sections.

E. Prosceniums are to be constructed of 2-hour fire rated construction and incorporate a deluge system in order to wet the curtain for up to 30 minutes in order to protect the audience from fire. Please see Section III.E for the applicable code sections.
F. Proscenium curtains are to be fire resistant and automatic closing for fire prevention. Please see Section III.F for specific proscenium curtain requirements.

G. Furniture used in theater productions is to be resistant to cigarette ignition (i.e., smoldering) in order to maintain a safe environment. Please see Section III.G for the applicable code sections.

III. GENERAL CODE REQUIREMENTS

A. Stages:

1. Section 8.15.16.1 of NFPA-13 states that sprinklers are to be installed under the roof at the ceiling, in spaces under the stage (see definition of stage in 410.2(6) (III.H.6)) either containing combustible materials or constructed of combustible materials, and in all adjacent spaces and dressing rooms, storerooms, and workshops.

2. Section 12.4.5.1 of NFPA-101 states that materials used in the construction of platforms (see definition of platform in 410.2(4) (III.H.6)) and stages are to conform to the applicable requirements of the local building code.

3. Section 12.4.5.3.1 of NFPA-101 states that regular stages (see definition of regular stage in 3.3.246.2 (III.H.3)) are to be of the materials required for the building construction type in which they are located. In all cases, the finish floor is to be permitted to be of wood.

4. Section 12.4.5.3.2 of NFPA-101 states that legitimate stages are to be constructed of materials required for Type I buildings, except that the area extending from the proscenium opening to the back wall of the stage, and for a distance of 6 ft beyond the proscenium opening on each side, are to be permitted to be constructed of steel or heavy timber covered with a wood floor not less than 1 ½ in. in actual thickness.

5. Section 12.4.5.3.3 of NFPA-101 states that openings through stage floors are to be equipped with tight-fitting traps with approved safety locks, and such traps are to comply with one of the following:
   (1) The traps are to be of wood having an actual thickness of not less than 1 ½ in.
   (2) The traps are to be of a material that provides fire and heat resistance at least equivalent to that provided by wood traps having an actual thickness of not less than 1 ½ in.

6. Section 410.3.1 of the IBC states that stages are to be constructed of materials as required for floors for the type of construction of the building in which such stages are located.

Exceptions:
(1) Stages of Type IIB or IV construction with a nominal 2-inch wood deck, provided that the stage is separated from other areas in accordance with Section 410.3.4 (III.E.12).

(2) In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided the space below the stage is equipped with an approved automatic fire-extinguishing system.

(3) In all types of construction, the finished floor is to be constructed of wood or approved noncombustible materials. Openings through stage floors are to be equipped with tight-fitting, solid wood trap doors with approved safety locks.

7. Section 410.3.1.1 of the IBC states that stage areas are to be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height is to be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the stage.

8. Section 410.3.2 of the IBC states that beams designed only for the attachment of portable or fixed theater equipment, gridirons (see definition of girdiron in 410.2(2) (III.H.6)), galleries and catwalks are to be constructed of approved materials consistent with the requirements for the type of construction of the building; and a fire-resistance rating is not to be required. These areas are not to be considered floors, stories, mezzanines or levels in applying this code. **Exception:** Floors of fly galleries and catwalks are to be constructed of any approved material.

9. Section 410.3.3 of the IBC states that where protection of openings is required, exterior exit doors are to be protected with approved fire door assemblies. Exterior openings that are located on the stage for means of egress or loading and unloading purposes, and that are likely to be open during occupancy of the theater, are to be constructed with vestibules to prevent air drafts into the auditorium.

10. Section 410.3.7 of the IBC states that emergency ventilation is to be provided for stages larger than 1,000 square feet in floor area, or with a stage height greater than 50 feet. Such ventilation is to comply with Section 410.3.7.1 or 410.3.7.2 (III.A.11 or III.A.12).

11. Section 410.3.7.1 of the IBC states that two or more vents constructed to open automatically by approved heat-activated devices and with an aggregate clear opening area of not less than 5 percent of the area of the stage is to be located near the center and above the highest part of the stage area. Supplemental means are to be provided for manual operation of the ventilator. Curbs are to be provided as required for skylights in Section 2610.2 (not included). Vents are to be labeled.

12. Section 410.3.7.2 of the IBC states that smoke control in accordance with Section 909 is to be provided to maintain the smoke layer interface not less than 6 feet
above the highest level of assembly seating or above the top of the proscenium opening where a proscenium wall (see definition of proscenium wall in 3.3.268.2 and 410.2(5) (III.H.4 and 6)) is provided in compliance with Section 410.3.4 (III.E.12).

13. Section 410.5.3 of the IBC states that at least one approved means of egress is to be provided from each side of the stage and from each side of the space under the stage. At least one means of escape is to be provided from each fly gallery (see definition of fly gallery in 410.2(1) (III.H.6)) and from the gridiron. A steel ladder, alternating tread stairway or spiral stairway is permitted to be provided from the gridiron to a scuttle in the stage roof.

14. Section 410.6 of the IBC states that stages are to be equipped with an approved automatic fire-extinguishing system. Sprinklers are to be installed under the roof and gridiron and under all catwalks and galleries over the stage. Sprinklers are to be installed in dressing rooms, performer lounges, shops and storerooms accessory to such stages.

**Exceptions:**

(1) Sprinklers are not required under stage areas less than 4 feet in clear height that are utilized exclusively for storage of tables and chairs, provided the concealed space is separated from the adjacent spaces by not less than 5/8-inch Type X gypsum board.

(2) Sprinklers are not required for stages 1,000 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 are to be limited to a single main curtain, borders, legs and a single backdrop.

(3) Sprinklers are not required within portable orchestra enclosures on stages.

15. Section 905.3.4 of the IFC states that stages greater than 1,000 square feet in area are to be equipped with a Class III wet standpipe system with 1 ½-inch and 2 ½-inch hose connections on each side of the stage.

**Exception:** Where the building or area is equipped throughout with an automatic sprinkler system, a 1 ½ inch hose connection is to be installed in accordance with NFPA 14 for Class II or III standpipes.

16. Section 905.3.4.1 of the IFC states that 1 ½-inch hose connections is to be equipped with sufficient lengths of 1 ½-inch hose to provide fire protection for the stage area. Hose connections are to be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

B. Scenery:
1. Section 12.4.5.11.1 of NFPA-101 states that combustible scenery of cloth, film, vegetation (dry), and similar materials are to meet the requirements of NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*.

2. Section 12.4.5.11.2 of NFPA-101 states that foamed plastics (see definition of cellular or foamed plastic in 3.3.36 (III.H.1)) are to be permitted to be used only by specific approval of the authority having jurisdiction.

3. Section 12.4.5.11.3 of NFPA-101 states that scenery and stage properties not separated from the audience by proscenium opening protection are to be of noncombustible materials, limited-combustible materials, or fire-retardant-treated wood.

4. Section 12.4.5.11.4 of NFPA-101 states that in theaters, motion picture theaters, and television stage settings, with or without horizontal projections, and in simulated caves and caverns of foamed plastic, any single fuel package is to have a heat release rate not to exceed 100 kW where tested in accordance with ANSI/UL 1975, *Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes*.

5. Section 12.7.4.1 of NFPA-101 states that fabrics and films used for decorative purposes, all draperies and curtains, and similar furnishings are to be in accordance with the provisions of 10.3.1 (III.F.3).

6. Section 12.7.4.2 of NFPA-101 states that the authority having jurisdiction is to impose controls on the quantity and arrangement of combustible contents in assembly occupancies to provide an adequate level of safety to life from fire.

7. Section 12.7.4.3 of NFPA-101 states that exposed foamed plastic materials and unprotected materials containing foamed plastic used for decorative purposes or stage scenery are to have a heat release rate not exceeding 100 kW where tested in accordance with ANSI/UL 1975, *Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes*.

8. Section 12.7.4.4 of NFPA-101 states that the requirement of 12.7.4.3 (III.B.7) is not to apply to individual foamed plastic items and items containing foamed plastic where the foamed plastic does not exceed 1 lb in weight.

9. Section 410.3.6 of the IBC states that combustible materials used in sets and scenery are to meet the fire propagation performance criteria of NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, in accordance with Section 806 and the *International Fire Code*. Foam plastics and materials containing foam plastics are to comply with Section 2603 and the *International Fire Code*.

C. Structures:
The majority of the following code sections apply to permanent structures. Code section 10.2.1.3 (III.C.3) applies to permanent and temporary structures and is marked with an *.

1. Section 10.2.1.1 of NFPA-101 states that classification of interior finish materials are to be in accordance with tests made under conditions simulating actual installations, provided that the authority having jurisdiction is permitted to establish the classification of any material on which rating by standard test is not available, unless otherwise provided in 10.2.1.2 (listed below).

2. Section 10.2.1.2 of NFPA-101 states that materials applied directly to the surface of walls and ceilings in a total thickness of less than 1/28 in. is not to be considered interior finish and is to be exempt from test simulating actual installation if they meet the requirements of Class A interior wall or ceiling finish when tested in accordance with 10.2.3 (III.C.6) using fiber cement board as the substrate material.

3. * Section 10.2.1.3 of NFPA-101 states that fixed or movable walls and partitions, paneling, wall pads, and crash pads applied structurally for decoration, acoustical correction, surface insulation, or other purposes are to be considered interior finish and are not to be considered decorations or furnishings.

4. Section 10.2.2.2 of NFPA-101 states that requirements for interior floor finish is to apply under any of the following conditions:
   (1) Where floor finish requirements are specified elsewhere in the Code
   (2) Where carpet or carpetlike material not meeting the requirements of ASTM D 2859, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials, is used
   (3) Where the fire performance of the floor finish cannot be demonstrated to be equivalent to floor finishes with a critical radiant flux of 0.1 W/cm²
   (4) Where the fire performance of the floor finish is unknown

5. Section 10.2.3 of NFPA-101 states that interior wall or ceiling finish that is required elsewhere in the Code to be Class A, Class B, or Class C is to be classified based on test results from ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, except as indicated in 10.2.3.1 or 10.2.3.2 (listed below).

6. Section 10.2.3.1 of NFPA-101 states that exposed portions of structural members complying with the requirements for Type IV construction (see definition of Type IV in III.H.5) in accordance with NFPA 220, Standard on Types of Building Construction, or with 7.2.5 of NFPA 5000, Building Construction and Safety Code, are to be exempt from testing and classification in accordance with ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.

7. Section 10.2.3.2 of NFPA-101 states that interior wall and ceiling finish tested in accordance with NFPA 286, Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth, and meeting the conditions of 10.2.3.7.3 (not applicable) are to be permitted to be used where interior wall and ceiling finish is required to be Class A in accordance with ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials.

8. Section 10.2.6.1 of NFPA-101 states that the required flame spread or smoke development classification of existing surfaces of walls, partitions, columns, and ceilings are to be permitted to be secured by applying approved fire-retardant coatings to surfaces having higher flame spread ratings than permitted. Such treatments are to be tested, or are to be listed and labeled for application to the material on which they are applied, and are to comply with the requirements of NFPA 703, Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials.

9. Section 10.2.6.2 of NFPA-101 states that fire retardant coatings are to possess the desired degree of permanency and are to be maintained so as to retain the effectiveness of the treatment under the service conditions encountered in actual use.

10. Section 410.5.1 of the IBC states that where the stage height is greater than 50 feet, the stage is to be separated from dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage and other parts of the building by a fire barrier with not less than a 2-hour fire-resistance rating with approved opening protectives. For stage heights of 50 feet or less, the required stage separation is to be a fire barrier with not less than 1-hour fire-resistance rating with approved opening protectives.

11. Section 410.5.2 of the IBC states that dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage are to be separated from each other by fire barriers with not less than a 1-hour fire-resistance rating with approved opening protectives.
D. Platforms:

- The requirements for smaller platforms located on stages are in section III.B of this document, Scenery.

1. Section 12.4.5.2.2 of NFPA-101 states that the space between the floor and the temporary platform above is not to be used for any purpose other than the electrical wiring of platform equipment.

2. Section 12.4.5.2.3 of NFPA-101 states that permanent platforms are to be of the materials required for the building construction type in which the permanent platform is located, except that the finish floor is to be permitted to be of wood in all types of construction.

3. Section 12.4.5.2.4 of NFPA-101 states that where the space beneath the permanent platform is used for storage or any purpose other than equipment wiring or plumbing, the floor construction is not to be less than 1-hour fire rated.

4. Section 410.4 of the IBC states that permanent platforms are to be constructed of materials as required for the type of construction of the building in which the permanent platform is located. Permanent platforms are permitted to be constructed of fire-retardant-treated wood for Type I, II, and IV construction where the platforms are not more than 30 inches above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet in area. Where the space beneath the permanent platform is used for storage or any other purpose other than equipment, wiring or plumbing, the floor construction is not to be less than 1-hour fire-resistance-rated construction. Where the space beneath the permanent platform is used only for equipment, wiring or plumbing, the underside of the permanent platform need not be rated.

5. Section 410.4.1 of the IBC states that platforms installed for a period of not more than 30 days are permitted to be constructed of any materials permitted by the code. The space between the floor and the platform above are only to be used for plumbing and electrical wiring to platform equipment. Please note that a permit is required by section 105 of the IBC.

6. Section 12.4.5.11.3 of NFPA-101 states that scenery and stage properties not separated from the audience by proscenium opening protection are to be of noncombustible materials, limited-combustible materials, or fire-retardant-treated wood.

E. Proscenium Wall:
1. Section 8.15.16.2 of NFPA-13 states that where proscenium opening protection is required, a deluge system is to be provided with open sprinklers located not more than 3 ft away from the stage side of the proscenium arch and spaced up to a maximum of 6 ft on center.

2. Section 12.4.5.6 of NFPA-101 states that legitimate stages are to be completely separated from the seating area by a proscenium wall of not less than 2-hour fire-resistive, noncombustible construction.

3. Section 12.4.5.6.1 of NFPA-101 states that the proscenium wall is not to extend less than 48 in. above the roof of the auditorium in combustible construction.

4. Section 12.4.5.6.2 of NFPA-101 states that all openings in the proscenium wall of a legitimate stage (see definition of a legitimate stage in 3.3.246.1 (III.H.2)) are to be protected by a fire assembly having a minimum 1 ½-hour fire protection rating.

5. Section 12.4.5.6.3 of NFPA-101 states that the main proscenium opening used for viewing performances is to be provided with proscenium opening protection as described in 12.4.5.7 (III.E.7-8).

6. Section 12.4.5.6.4 of NFPA-101 states that proscenium walls are not to be required in smoke-protected assembly seating facilities constructed and operated in accordance with 12.4.2 (In general, smoke-protected assembly seating is defined as seating served by means of egress that is not subject to smoke accumulation within or under the structure).

7. Section 12.4.5.7.1 of NFPA-101 states that where required by 12.4.5.6 (III.E.3-6), the proscenium opening is to be protected by a listed, minimum 20-minute opening protective assembly, a fire curtain complying with NFPA 80, Standard for Fire Doors and Other Opening Protectives, (if information regarding fire curtains is required, please contact FLS) or an approved water curtain complying with NFPA 13, Standard for the Installation of Sprinkler Systems.

8. Section 12.4.5.7.2 of NFPA-101 states that proscenium opening protection provided by other than a fire curtain are to activate upon automatic detection of a fire and upon manual activation.

9. Section 13.4.5.7.1 of NFPA-101 states that on every legitimate stage, the main proscenium opening used for viewing performances is to be provided with proscenium opening protection as follows:
   (1) The proscenium opening protection is to comply with 12.4.5.7 (III.E.7-8).
   (2) Asbestos is to be permitted in lieu of a listed fabric. (Note: Asbestos not permitted on campus)
   (3) Manual curtains of any size are to be permitted.
7. Section 410.3.4 of the IBC states that where the stage height is greater than 50 feet, all portions of the stage are to be completely separated from the seating area by a proscenium wall with not less than a 2-hour fire-resistance rating extending continuously from the foundation to the roof.

F. Proscenium Curtains and Other Curtains & Draperies:

1. Section 13.4.5.7.2 of NFPA-101 states that in lieu of the protection required by 13.4.5.7.1(1) (III.E.7), all the following are to be provided:
   (1) A noncombustible opaque fabric curtain is to be arranged so that it closes automatically.
   (2) An automatic, fixed waterspray deluge system is to be located on the auditorium side of the proscenium opening and is to be arranged so that the entire face of the curtain will be wetted, and the following requirements also are to apply:
      (1) The system is to be activated by a combination of rate-of-rise and fixed-temperature detectors located on the ceiling of the stage.
      (2) Detectors are to be spaced in accordance with their listing.
      (3) The water supply is to be controlled by a deluge valve and is to be sufficient to keep the curtain completely wet for 30 minutes or until the valve is closed by fire department personnel.
      (3) The curtain is to be automatically operated in case of fire by a combination of rate-of-rise and fixed-temperature detectors that also activates the deluge spray system.
      (4) Stage sprinklers and vents are to be automatically operated by fusible elements in case of fire.
      (5) Operation of the stage sprinkler system or spray deluge valve is to automatically activate the emergency ventilating system and close the curtain.
      (6) The curtain, vents, and spray deluge system valve are also to be capable of manual operation.

2. Section 410.3.5 of the IBC states that where a proscenium wall is required to have a fire-resistance rating, the stage opening is to be provided with a fire curtain of approved material or an approved water curtain. The fire curtain is to be designed and installed to intercept hot gases, flames and smoke to prevent a glow from a severe fire on the stage from showing on the auditorium side for a period of 20 minutes. The closing of the fire curtain from the full open position is to be accomplished in less than 30 seconds, with the last 8 feet of travel requiring 5 or more seconds for full closure.

3. Section 10.3.1 of NFPA-101 states that where required by the applicable provisions of this Code, draperies, curtains, and other similar loosely hanging furnishings and decorations are to meet the flame propagation performance criteria contained in NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
G. Furniture:

1. Section 10.3.2.1 of NFPA-101 states that newly introduced upholstered furniture, except as otherwise permitted by Chapters 11 through 43, are to be resistant to cigarette ignition (i.e., smoldering) in accordance with one of the following:
   (1) The components of the upholstered furniture are to meet the requirements for Class I when tested in accordance with NFPA 260, Standard Methods of Tests and Classification Systems for Cigarette Ignition Resistance of Components of Upholstered Furniture, or with ASTM E 1353, Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture.
   (2) Mocked-up composites of the upholstered furniture are to have a char length not exceeding 1 ½ in. when tested in accordance with NFPA 261, Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes, or with ASTM E 1352 Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies.

2. Section 10.3.2.2 of NFPA-101 states that newly introduced mattresses, except as otherwise permitted by Chapters 11 through 43, are to have char length not exceeding 2 in. when tested in accordance with 16 CFR 1632, “Standard for the Flammability of Mattresses and Mattress Pads” (FF 4-72).

H. Definitions:

1. Section 3.3.36 of NFPA-101 states that cellular or foamed plastic is a heterogeneous system comprised of not less than two phases, one of which is a continuous, polymeric, organic material, and the second of which is deliberately introduced for the purpose of distributing gas in voids throughout the material.

2. Section 3.3.246.1 of NFPA-101 states that a legitimate stage is a stage with a height greater than 50 ft measured from the lowest point on the stage floor to the highest point of the roof or floor deck above and greater than 1000 square feet.

3. Section 3.3.246.2 of NFPA-101 states that a regular stage is a stage with a height of 50 ft or less measured from the lowest point on the stage floor to the highest point on the roof or floor deck above.

4. Section 3.3.268.2 of NFPA-101 states that a proscenium wall is the wall that separates the stage from the auditorium or house.

5. Section 7.2.5 of NFPA-5000 states that Type IV construction is to be the type in which fire walls, exterior walls, and interior bearing walls and structural elements that are portions of such walls are of approved noncombustible or limited-combustible materials. Other interior structural elements, arches, floors, and roofs are to be of solid or laminated wood without concealed spaces and are to comply
with the allowable dimensions of 7.2.5.5. (Please contact FLS for dimensions of specific elements)

6. Section 410.2 of the IBC defines the following:
   (1) Fly Gallery: A raised floor area above a stage from which the movement of scenery and operation of other stage effects are controlled.
   (2) Gridiron: The structural framing over a stage supporting equipment for hanging or flying scenery and other stage effects.
   (3) Pinrail: A rail on or above a stage through which belaying pins are inserted and to which lines are fastened.
   (4) Platform: A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round stages; and similar purposes wherein there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.
   (5) Proscenium Wall: The wall that separates the stage from the auditorium or assembly seating area.
   (6) Stage: A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.