

**White Paper**

**Navigating Fire Codes in Repairs, Renovations, Alterations, Modifications, and More**

By Adam Paterson, PE

**Introduction**

Renovating a facility is a complex undertaking. Properly communicating the project design to clients, contractors, and authorities is the goal. Even the generic term “Renovating” can be incorrect for particular projects. Defining appropriate building code and life safety terminology begins with model building codes and standards. These model building codes and standards are adopted by States and other authority having jurisdictions (AHJ) like the Department of Defense (DoD) or General Services Administration (GSA).

The amount of effort it takes to track the applicable codes and standards varies. It can be a simple task for small office projects in new facilities or it can be convoluted for more complex projects where clients have created their own standards for future undefined users. In both scenarios, accurately defining regulations early during projects improves estimating scope definition, construction costs, and schedules. Fire protection engineers play a vital role during a renovation project determining life safety systems compliance. The fire protection discipline focuses on building and life safety code consultation, fire suppression, and emergency communications systems. Fire protection is a broad engineering field tracing its roots back to insurance risk analysis in the early 20<sup>th</sup> century.

**Building code basics**

Building code and life safety regulations provide minimum construction criteria for protecting people and property. These minimum construction criteria are based upon the building occupancy classification. Fire protection engineers excel in determining building code and life safety compliance.

Both the International Code Council (ICC) and National Fire Protection Association (NFPA) create building code and life safety criteria. NFPA 101, Life Safety Code, has a long history and dates back to 1913 under the name “Committee on Safety to Life”. The International Building Code (IBC) and International Existing Building Code (IEBC) are part of a code series from the ICC and an accumulation of three previous regional codes combined into a national standard. The International Code Council was formed in 1995 for this task.

Both standard development organizations have released the 2018 code cycles. Some authorities have adopted the new regulations, however most have not made the leap.

For existing buildings, the ICC utilizes the International Existing Building Code (IEBC) and NFPA utilizes NFPA 101, Life Safety Code. Both the IEBC and NFPA 101 categorize work performed in existing facilities based upon the extent of construction. Understanding this approach is critical to properly defining the project scope.

**Prescriptive or Performance based?**

Building code and life safety compliance can be prescriptive or performance based. Prescriptive regulations are found in codes and standards. Frequently, existing facilities cannot meet prescriptive regulations. Performance based design uses quantitative engineering methods to provide equivalent protection to prescriptive regulations. Performance based design (PBD) is complicated, costly, and not addressed here. Many people believe PBD is the future of fire protection engineering. The PBD protection approach has been adopted in European countries as the baseline.

## Navigating the code

All work involving existing buildings, regardless of the definition, requires the building to be as safe as before the project began but not more safe than required by new construction. This is a key approach in conversations with AHJs about existing non-required life safety systems.

In Chapter 3, the IEBC categorizes project compliance in one of three ways: prescriptive, work area, or performance. Prescriptive requirements are in Chapter 5, work area requirements in Chapters 6 through 12, and performance requirements in Chapter 13. The IEBC work categories are Repairs, Alterations, Additions, Change of Occupancies, and Relocations. These last three categories, Additions, Change of Occupancies, and Relocations, are not addressed in this white paper.

In NFPA 101, Chapter 43, Rehabilitation categories are Repair, Renovation, Modification, Reconstruction, Change of Use, and Addition. Similar to the IEBC, NFPA 101 has both performance and prescriptive compliance options. These approaches are located in NFPA 101, Chapter 4.4.

## Repairs

Repairs are limited to minor deficiency corrections like painting damaged walls, changing a carpet tile, or replacing a sprinkler head. See below for the definitions between the two codes.

NFPA 101 Repairs	IEBC Repair
"The patching, restoration, or painting of materials, elements, equipment, or fixtures for the purpose of maintaining such materials, elements, equipment, or fixtures in good or sound condition."	"The reconstruction, replacement or renewal of any part of an existing building for the purpose of maintenance or to correct damage."

**Beyond repairs**

Most projects involving considerable repair work are not defined as *Repairs*. The classification is escalated up to the next level. Beyond repairs, scope definition can accumulate and fall under multiple classifications sharing similar requirements. The terminology between NFPA 101 and IEBC is different but they have a relative association.

*Approximate Equals: Renovation vs Alteration level 1*

NFPA 101 Renovation	IEBC Alteration level 1
"The replacement in kind, strengthening, or upgrading of building elements, materials, equipment, or fixtures, that does not result in a reconfiguration of the building spaces within."	"The removal and replacement or covering of the existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose."

Renovations are defined by NFPA 101 but it is also a general populace term. IEBC Chapter 7 has the criteria this type of work needs to meet. The new work needs to comply with what has already been installed except for all new interior wall/floor finish needs to meet the IBC or NFPA 101 criteria.

*Approximate Equals: Modifications vs Alteration level 2*

NFPA 101 Modifications	IEBC Alteration level 2
"The reconfiguration of any space; the addition, relocation, or elimination of any door or window; the addition or elimination of load-bearing elements; the reconfiguration or extension of any system; or the installation of any additional equipment."	"The reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment."

This next level of work involves modifying structure or means of egress components, i.e. windows and doors. Modifications and Alteration level 2 require new constructed elements, components, and systems to comply with new criteria. Alteration level 2 requires a detailed review of vertical openings, fire suppression and alarm systems, means of egress components, and electrical/mechanical/plumbing equipment.

*Approximate Equals: Reconstructions vs Alteration level 3*

<b>NFPA 101 Reconstructions</b>	<b>IEBC Alteration level 3</b>
<p>“The reconfiguration of a space that affects an exit or a corridor shared by more than one occupant space; or the reconfiguration of a space such that the rehabilitation work area is not permitted to be occupied because existing means of egress and fire protection systems, or their equivalent, are not in place or continuously maintained.”</p>	<p>“Alterations where the work area exceeds 50 percent of the building area.”</p>

Extensive modifications shall be treated as Reconstructions or Alteration level 3. Systems only upgrades are never considered Reconstructions. An example of a system upgrade would be a full steam power plant replacement not requiring any facility upgrades to equipment not associated with the system.

NFPA Reconstruction requires fire suppression and fire alarm systems be installed throughout the building up to the highest floor of the work area, if required under new construction by occupancy. Means of egress emergency lighting and exit marking also needs to be reviewed and installed in the same manner.

IEBC Alteration level 3 requires HVAC systems over 15,000 CFM located in high rise buildings be provided with smoke detection and fire-fighter recall be provided in a single public elevator. Additionally, stairs must be enclosed up to the highest floor work area and down to the level of exit discharge. Fire suppression and fire alarm equipment should be installed where required for new construction. Means of egress emergency lighting and marking shall be provided.

## Reference

Quick reference tables for both the 2018 NFPA 101 and IEBC 2018 criteria are below. Please remember to determine the proper jurisdictional code edition before referencing these tables. These codes are cyclical and requirements change frequently or chapters shift.

## Conclusion

Classifying life safety requirements for construction projects in existing buildings and structures is a complicated process. Finding existing issue-for-construction documents or as-builts is a great start to determining building construction classification by current codes.

Involving the AHJ early as possible in complicated projects removes a large degree of risk. Regardless of how you understand prescriptive requirements, many AHJs have their own interpretations. Work areas can have varied scope. Spaces where work classifications overlap shall meet the most restrictive classification criteria if the separation is not obvious. If the facility remains occupied during construction determine how to handle NFPA 241. Finally, many clients have their own set of requirements which compound the criteria. Having an experienced fire protection engineer integrated into the project team streamlines the project design.

### About the author

Adam Paterson, PE is a Senior Fire Protection Engineer for Summer Consultants, Inc. He has over 10 years of dedicated fire protection consulting experience on building regulations compliance, standard and alternative suppression systems design, and emergency voice fire alarm system design. His experience spans across various clients, facilities, and roles in the fire protection industry.

Adam received his bachelor's degree in Mechanical Engineering from Virginia Tech. He is pursuing a master's degree in Fire Protection Engineering from Worcester Polytechnic Institute. He is a professional engineer in Fire Protection Engineering in multiple states and is a member of the Society of Fire Protection Engineers.

Quick Reference Table: 2018 NFPA 101 Rehabilitation							
Classification	Definition	Criteria Location	General	Building Elements and Materials	Fire Protection	Means of Egress	Special Conditions
Repair	The patching, restoration, or painting of materials, elements, equipment, or fixtures for the purpose of maintaining such materials, elements, equipment, or fixtures in good or sound condition.	Chapter 43.3	Shall not make the building any less compliant.				
Renovation	The replacement in kind, strengthening, or upgrading of building elements, materials, equipment, or fixtures, that does not result in a reconfiguration of the building spaces within.	Chapter 43.4	All new work shall be in compliance with existing occupancy requirements and not make it less conforming with requirements.	Interior finish requirements shall meet new construction requirements.		Egress shall be able to support occupant load unless AHJ allows otherwise.	Reconfiguration shall meet 43.5 requirements
Modification	The reconfiguration of any space; the addition, relocation, or elimination of any door or window; the addition or elimination of load-bearing elements; the reconfiguration or extension of any system; or the installation of any additional equipment.	Chapter 43.5	All new work shall be in compliance with new occupancy requirements.	Work in excess of 50% building area shall be Reconstruction. Systems only work shall not require increase to Reconstruction			
Reconstruction	The reconfiguration of a space that affects an exit or a corridor shared by more than one occupant space; or the reconfiguration of a space such that the rehabilitation work area is not permitted to be occupied because existing means of egress and fire protection systems, or their equivalent, are not in place or continuously maintained.	Chapter 43.6			(1) Sprinklers shall be installed throughout and up to the highest level of work area. If only involved on a single floor, sprinkler should be provided throughout the floor. (2) Standpipe shall be provided where required for new construction up to the highest level of work area. (3) fire pumps will not be required, see section 43.6.4.6. (4)	(1) Illumination, emergency lighting, and marking of means of egress shall be in accordance with new occupancy construction. (2) Where work area exceeds 50% of the floor area entire floor shall be upgraded.	
Change of Occupancy	Change in the use of a building or portion of a building that results in any of the following: (1) A change of occupancy classification. (2) A change from one group to another group within an occupancy classification. (3) Any change in use within a group for which there is a change in application of the requirements of this code.	Chapter 43.7	Change of use or occupancy classification goes from a lower hazard to a higher hazard requirements shall meet the criteria				
Addition	An increase in the building area, aggregate floor area, building height, or number of stories of a structure.	Chapter 43.8	All new work shall comply with new construction for the occupancy. Existing portions shall meet the existing building for the occupancy.	The addition shall not create or extend any nonconforming fire safety issues. Building height shall be limited to that for new construction.			
Historic Building	Any building or structure that is one or more of the following: (1) Listed or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the Nation Register of Historic Places, in the National Register of Historic Places (2) Designated as historic under an applicable state or local law. (3) Certified as a contributing resource within a National Register, state designated or locally designated historic district.	Chapter 43.10			Conduct a historic building evaluation in accordance with 43.10.2.		

Quick Reference Table: 2018 IEBC Work Area Method Compliance 301.3.2										
Classification	Definition	Criteria Location	General	Building Elements and Materials	Fire Protection	Means of Egress	Structural	Electrical	Mechanical	Plumbing
Repair	<i>The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.</i>	Chapter 4	Shall not make the building any less compliant.	Glazing shall be in accordance with IBC.	Maintain level of protection.	Maintain level of protection.	See section 405	Like material See section 406.1.1-5	Like material See section 407.2	Prohibited materials in IBC cannot be used.
Alteration Level 1	<i>The removal and replacement or covering of the existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose.</i>	Chapter 7	Shall not make the building any less compliant. Modify emergency escape per 701.4	Inter wall, floor finish, trim, windows, and new work shall comply with current code.	Maintain level of protection.	Maintain level of protection.	See section 706.			
Alteration Level 2	<i>The reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment</i>	Chapter 8	Comply with chapter 7 and new construction elements shall be in accordance with 801.3	(1) Work is limited to work areas and extended where indicated in this chapter. (2) Existing vertical openings connecting two or more floors shall have not less than a 1-hour fire resistance rating except when indicated under 802.2.1. (3) Shaft and floor opening enclosure(s) are required where 50% of the floor work area is exceeded. (4) Stairways outside the area of work are required to be enclosed with smoke tight construction where 50% of the floor work area is exceeded.	(1) If an automatic sprinkler system is installed throughout the work area story then corridor ratings can be reduced in accordance with IBC. (2) Sprinklers should be installed in accordance with 803.2.2 for occupancies listed. (3) Standpipes should be present when work area includes exits or corridors shared by more than one tenant or when above or below 50 feet. A pump is not required when the exception language is met.	Comply with this section unless it meets NFPA 101 criteria. (1) Number of exits - 805.3.1 (2) Fire escapes - 805.3.1.2 (3) Mezzanines - 805.3.2 (4) Egress Doorways - 805.4 (5) Corridor walls - 805.5 (6) Dead end corridors - 805.6 (7) Lighting - 805.7 (8) Exit Signs - 805.8 (9) Handrails - 805.9 (10) Refuge area - 805.10 (11) Guards - 805.11	See section 806.	Meet NFPA 70 for new equipment and existing equipment needs to be upgraded in occupancies A, H, and I.	Meet IMC for new equipment or section 808.2.	Meet IPC when occupant load is increased by 20%.
Alteration Level 3	<i>Alterations where the work area exceeds 50 percent of the building area.</i>	Chapter 9	Comply with chapter 7, 8, and 9.	(1) Enclose shafts and vertical openings from highest level of work area floor to level of exit discharge and all floors below.	(1) Provide sprinklers in area where listed under 904. (2) Provide fire alarm and detection where required in accordance with IBC.	Provide means of egress lighting and signage from work area floor through exit enclosure.	See section 906.			
Change of Occupancy	<i>Change in the use of a building or portion of a building that results in any of the following: (1) A change of occupancy classification. (2) A change from one group to another group within an occupancy classification. (3) Any change in use within a group for which there is a change in application of the requirements of this code.</i>	Chapter 10	(1) Code official must provide new certificate of occupancy	Comply with 1011 where new occupancy exists.	Comply with 1011 where new occupancy exists.	Comply with 1011 where new occupancy exists.	See section 1006.	Special occupancies must meet new NFPA 70 criteria, unsafe conditions corrected, service upgraded, and number of outlets per new occupancy criteria.	New occupancy must meet IMC for new work.	Fixture requirements must meet IPC for new occupancy.
Change of Occupancy	<i>Section 1011 criteria</i>			(1) New occupancy requirements extend throughout the building unless properly separated in accordance with IBC separated occupancy criteria. (2) New occupancy fire suppression and fire alarm should be provided throughout. (3) See hazard categories of table 1011.4 and if a new occupancy is a higher hazard means of egress should be upgraded. (4) Heights and areas shall be per the new occupancy in accordance with IBC chapter 5. Fire wall alternatives see section 1011.5.1.1. (5) Stairways and shafts shall be enclosed when a higher hazard is introduced.						
Addition	<i>An extension or increase in floor area, number of stories, or height of a building or structure</i>	Chapter 11	New work shall meet the IBC and requirements for new construction.	Heights and Areas - addition cannot increase above what is permitted in IBC chapter 5/6.			See section 1103.			
Historic Building	<i>Any building or structure that is one or more of the following: (1) Listed or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the Nation Register of Historic Places, in the National Register of Historic Places (2) Designated as historic under an applicable state or local law. (3) Certified as a contributing resource within a National Register, state designated or locally designated historic district.</i>	Chapter 12	A historic report shall be created.	Working on a historic building requires substantial research and coordination with all team members.						
Moved Building	<i>Relocated Building</i>	Chapter 14	Building shall be safe and any work done shall be in accordance with the applicable chapter.	Building shall be located on the lot in accordance with IBC criteria.						