



SPEAKING IN CODE

The Lowdown on Testing and Special Inspection Topics

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SPECIAL INSPECTIONS AND PUBLIC SAFETY



Special inspections are defined by the International Building Code (IBC) as “Inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with this code and the approved construction documents.” While the IBC definition is accurate, it does not clarify what special inspections are or detail the specific inspections and tests involved. Let’s create our own special inspections definition below.

Special inspections are a specialized form of inspection mandated largely by modern model building codes. They were designed to ensure critical or high-risk structural elements are built in accordance with approved design documents and the building code. These special inspections and tests are performed on construction procedures and materials.

Special inspections were created to protect public safety. Numerous locations in the IBC code, especially Chapters 1, 2, and 3 (*Scope and Administration, Definitions, and Occupancy Classification and Use*), contain such requirements. In the 1970s and 1980s, an alarming increase in major construction failures resulted in loss of life. Three failed projects are as follows:

- 1. Skyline Plaza.** In March 1973, the 25-story Skyline Plaza condominium building, under construction in Fairfax, VA, collapsed, killing 14 construction workers and injuring 35 others. The collapse occurred while shoring was being removed between the 22nd and 23rd floors of the building. Additional concrete was being placed on the 24th floor at the same time. The cause of the failure was determined to be premature removal of the shoring beneath the 22nd and 23rd floors, plus improper installation of the shoring.
- 2. Rosemont Horizon Arena.** The Rosemont Horizon Arena in Chicago, IL, collapsed in 1978, killing five construction workers. Investigation of the 90% complete roof revealed that 53% of the required connection bolts were missing, and that improper installation was observed on 27% of the “compensating steel plates.” Many instances of inadequate bracing also existed.
- 3. Kansas City Hyatt Regency Hotel.** Two overhead walkways in the hotel collapsed during a dance party. The collapse killed 114 people and injured more than 200, making it the deadliest structural failure in U.S. history at the time. The disaster was caused by a critical change in hanger rod installation during construction phases that doubled the load on the fourth-floor hanger rods, which subsequently failed.

Project construction failures like these, along with the associated loss of life, caused the U.S. House of Representatives to study the three failures in addition to many other similar incidents. The resulting House Report 98-621 (1984) concluded that the root cause of the construction failures were:

- Insufficient inspection by the Design Professional-of-Record during construction
- Lack of organization and communication between project parties
- The absence of the Engineer-of-Record on the job site, allowing the defects to go unnoticed

Data relating to new construction failures per specific construction discipline (soil, concrete, masonry, structural steel, etc.) is scarce. However, research involving building code and public safety indicates that about 80% of all construction failures can be attributed to workmanship and construction practices at the job site during construction. About 20% of construction failures are caused by defective materials deemed noncompliant with building code* requirements and contract documents.

**The use of the term building code in most building code vernacular means general building code, consisting of the International Building Code (IBC) and the applicable Statewide Building Code.*

Construction failures and noncompliance items vary widely and are attributed to all disciplines involved in new project construction. These noncompliant construction materials and procedures are typically predictable, so a good, solid quality assurance program will detect them, allow them to be repaired, and resolve them.

First, it is important to know that 70% of new project construction defect litigation involves water intrusion of the building envelope. While most of these water intrusion defects do not affect public safety and are not technically structural failures, some do. Waterproofing, flashing, and window installation make up most of this list and are the leading causes of project claims and lawsuits.

Typical project discrepancies occurring during construction are noted below:

- Soils/geotechnical noncompliance items are often the result of inadequate soil compaction, leading to unexpected settlement, foundation cracks, or volume change (movement) 5-10%
- Typical structural steel and welding discrepancies include lack of proper weld certifications for the project, improperly tightened bolts, weld discontinuities (cracking, lack of penetration), and incorrect positioning of structural elements 5-10%
- Concrete discrepancies are typically found in the plastic concrete field tests (slump, air content, temperature, unit weight, and yield) – a failure to achieve the required compressive strength is a major factor, as is improper curing, segregation, and structural steel placement 15-20%
- Masonry discrepancies include lack of a proper mortar mix design compliant with the code, a lower fire rating than required by code, mortar joint failures, placement of rebar and grout, and improper submittals 15-20%
- Sprayed Fire-Resistive Materials (SFRM) discrepancies cause a high rate of repair and include bond strength defects, thickness and density defects, and application in cold weather/otherwise improper temperatures as required by code 10-15%
- Other discrepancies may be associated with seismic force-resisting systems, occupancy/use, exterior insulation and finish systems (EIFS), wood, and materials laboratory, etc. 10-25%



Well before the 1984 U.S. Congressional legal action regarding construction failures, Virginia and other states began implementing sweeping code changes aimed at protecting public safety. The Uniform Virginia Statewide Building Code (UVSBC) was created in 1973, but some jurisdictions received extensions during this time. Virginia achieved full implementation in 1975, when all jurisdictions were required to enforce the UVSBC, which adopted the Building Officials and Code Administrators (BOCA) code (1993). Though the Virginia statewide code formally adopted the BOCA code, it would transition and adopt the International Building Code (IBC) code in 2000. That first edition of the IBC code more or less copied the existing BOCA code. These two codes introduced most of us in the design and construction community to the term “special inspections” for the first time. On the other hand, North Carolina



adopted the IBC 2000 edition of the code in 2002; until 2002, the state used the Southern Standard Building Code (SSBC). The SSBC was created in 1945, and most southern states followed this legacy code before transitioning to IBC.

In summary, a lack of proper inspection, communication, and testing on construction projects, as highlighted by several high-profile structural failures in the 1970s and 1980s, was the primary catalyst for the creation of modern “special inspections.” By extension, special inspections influenced the development of the comprehensive International Building Code (IBC). Major building failures can, and should, also continue to influence code updates. A good measure of the magnitude and necessity of some of these evolving building code changes is SFRM special inspections requirements. The National Institute of Standards and Technology (NIST) investigated the collapse of the World Trade Center towers after 9-11, resulting in significant code changes to the required bond strengths of SFRM and the frequency of field testing. The code-required bond strength was increased from the existing 150 psf to 430 psf and 1000 psf for high-rise buildings over 75 feet tall (approximately six stories), almost quadrupling the frequency of bond-strength and SFRM-thickness testing. Ultimately, the driving force behind changing building codes in the 1980s, 1990s, and beyond is public safety.



But wait! We have a lot more to say! For a complete picture of the Code and how it relates to Special Inspections, F&R would love to provide a virtual AIA-accredited Lunch & Learn presentation to the professionals at your firm.

Trouble Deciphering the Code? Call the Experts at F&R!

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