



SPEAKING IN CODE

The Lowdown on Testing and Special Inspection Topics

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SPECIAL INSPECTIONS & ASTM STANDARDS



The invaluable link between project special inspections, ASTM International, and ASTM standards is undeniable. More than 13,000 ASTM standards exist, and approximately 300 of those ASTM standards are adopted by the International Building Code (IBC) and listed in Chapter 35 of the IBC codebook. Many people in the design and construction industry consider the inspection and testing methods stipulated in the 300 ASTM standards (adopted by the IBC) to be designated IBC special inspections in their own right.

Considering IBC adopted ASTM standard inspection and testing requirements, automatic IBC project special inspections are, at least, arguable. The IBC technical staff will tell you that the invocation of ASTM standards in IBC Chapter 35 (as well as other

IBC chapters) does not automatically mean that all inspection and testing criteria from the ASTM standards become mandatory (special inspections) requirements of the IBC building code.

The IBC code only adopts referenced ASTM standards to the “prescribed extent of each such reference.” The IBC code specifies the various special inspections and tests that are required, and adopted referenced ASTM standards inform the specifics of those requirements. Vague verbiage like the previous two sentences tends to make special inspectors’ heads explode. On the other hand, the general comments of Chapter 35 (referenced standards) seem to be straightforward when you read, “Once a (referenced) standard is incorporated into the IBC code, it becomes an enforceable part of the code. When the (IBC) code is adopted by a jurisdiction, the standard is also a part of the jurisdiction’s adopted code.” The IBC code does advise that where conflicts occur between provisions of the IBC code and referenced codes and standards, the provisions of the IBC code take precedence and shall apply.

Regardless of the difficulty in determining how much of various ASTM standards language IBC judges to be mandatory, special inspectors must still be very aware and knowledgeable of ASTM requirements for materials testing and inspection due to the interplay between the IBC code, ASTM standards, and project contract documents. On the subject of the interaction of the IBC code, ASTM standards, and the project contract documents, it is essential to remember that the project special inspector is charged with the responsibility of verifying compliance of construction materials and construction procedures with applicable acceptance criteria of the IBC code and the contract documents (IBC Chapter 2). ASTM standards are referenced in both the code and the contract documents, and most of the applicable ASTM standards for project work are written in mandatory language.

It is accurate to say that the project special inspector must have a good working knowledge of a large number of ASTM standards, regardless of the particular discipline (soil, concrete, masonry, reinforcing steel, structural steel, wood, sprayed fire-resistant materials, etc.). While it is recognized that not all inspections and tests required by ASTM standards are classified as special inspections, some of them are because IBC and other model codes define specific ASTM standards as special inspections. It is also fair to say that ASTM standards are voluntary but widely adopted. Although ASTM does not enforce compliance, its standards are frequently cited in construction project contract documents, model codes, and government regulations, making them code-required and/or required by the contract documents.

Soils Special Inspections

Section 1705.6 of IBC Chapter 17 requires special inspections and tests of existing site soil conditions and placement of compacted fill. In this same section, IBC stipulates that the approved geotechnical report and the project construction documents prepared by registered design professionals be used to determine compliance of selected earthwork operations. The approved project geotechnical report (and the contract documents) will always invoke numerous ASTM standards listed in IBC Chapters 17 and 18, which become IBC code acceptance criteria for the project's earthwork phases. These ASTM standards encompass various laboratory and field tests used to classify the proposed project's fill soils, determining their suitability for use on the project. The approved geotechnical report may also reference other model codes and standards that address code acceptance criteria, including controlled low-strength material (CLSM), sometimes referred to as "flowable fill," as well as polyethylene vapor retarders for slab-on-grade construction (IBC section 1907). The IBC code (Chapters 16, 17, and 18) has much code acceptance criteria within the three IBC chapters; however, ASCE/SEI 7, Chapter 20, is given total responsibility by the IBC code to determine the site classification of the project site.



Concrete Special Inspections

The IBC code, Chapter 17, Table 1705.3, lists a plethora of minimum special inspections required by the IBC code. Table 1705.3 references numerous ASTM standards, particularly when reviewing all the standards listed in Table 1705.3 and their corresponding ASTM designations. IBC referenced ASTM standards, and ASTM standards adopted by the concrete building code (ACI 318), will startle you with the raw number of them alone (75 to 100); however, a lot of them do not pertain to concrete special inspections. The concrete special inspector will need to be familiar with about a dozen ASTM standards invoked that include ASTM C29, C31, C33, C39, C42, C94, C138, C330, C143, C567, C231, and C260. These standards include all plastic concrete tests to be performed in the field during the project construction phase, as well as the Specification for Concrete Aggregates (ASTM C33), plus the Concrete Ready-Mix Specification (ASTM C94). IBC and the contract documents often point out critical ASTM standards for proper methods, tests, and inspections used to verify compliance with code-required criteria.

Concrete Reinforcing Steel Special Inspections

Project contract documents require that reinforcing steel be placed in accordance with Concrete Reinforcing Steel Institute (CRSI) criteria. During special inspection, the inspector verifies that the rebar used on the project conforms to the approved construction documents, CRSI required criteria, applicable ASTM standards, and other American Concrete Institute model codes. The rebar will be required to comply with ASTM A15, A706, and other ASTM



standards. While CRSI does set forth rebar placement tolerances, the rebar must also be placed in accordance with ACI 117, *"Specification for Tolerances for Concrete Construction & Materials."*



Masonry Special Inspections

The IBC code does list a few special inspection items in IBC, Chapters 17 and 21, but the "lion's share" of masonry special inspections are listed in TMS 402/602, *"Building Code Requirements and Specifications for Masonry Structures."* Table 4 of TMS 602 lists a profusion of minimum special inspections when including the inspections cited by the "reference criteria columns," and many of these special inspections utilize ASTM standards to verify compliance with special inspections. In TMS 602 alone, between articles 1.3 and 3.8, there are references to dozens of special inspections and tests, as well as references to appropriate ASTM standards to verify code compliance.

Table 3 of TMS 602 is a new table that was not previously published, addressing numerous building procedures and material code acceptance criteria that must be verified. Cold and hot weather special inspections are specified in articles 1.8C and 1.8D of TMS 602 and address maintaining masonry sand piles in a damp, loose condition, mortar mixing times, mortar/grout temperatures, mortar retempering, minimum and maximum temperature ranges of concrete masonry units, sand, grout, and the covering of masonry walls at the end of the masonry work day. Key ASTM standards for the masonry special inspector are CMU specifications (ASTM C90), testing CMU (C140), specification for mortar aggregates (C144), mortar specifications (ASTM C270), specification for masonry grout (C476), and the *"Standard Test Method for Sampling and Testing Grout for Masonry"* (C1019).

Structural Steel Special Inspections

IBC code, Chapter 17, Section 1705.2.1, states, "Structural steel special inspections and nondestructive testing of structural steel elements in buildings and other structures shall be in accordance with the quality assurance requirements of AISC 360 (American Institute of Steel Construction)." AISC 360, especially Chapter N, stipulates inspections and tests for the special inspector to provide on the steel elements of the project. AISC 360 also includes a large number of ASTM standards to assist in verifying the code acceptance criteria outlined in AISC 360. The American Welding Society (AWS), AISI S240, *"North American Standard for Cold-Formed Steel Framing,"* and the Research Council on Structural Connections (RCSC) also present inspection methodologies and test methods to verify the code requirements of AISC 360, along with another couple of dozen or so ASTM standards to help confirm the IBC and AISC 360 code acceptance criteria. AISC 303, *"Code of Standard Practice for Steel Buildings and Bridges,"* is also a valuable model code that establishes industry-standard rules and procedures for contracts involving the design, fabrication, and erection of structural steel elements for buildings and bridges. The steel discipline of special inspections has adopted more model codes than any other special inspection discipline, and those model codes include the Steel Deck Institute's *"SDI QA/QC Quality Assurance Manual"*. The Steel Joist Institute (SJI) also produces three key model codes and standards that influence special inspections related to steel joists and girders on project work.

1. SJI *"Code of Standard Practice"* which details standard practices for fabrication and erection
2. SJI 100, the standard specification for K-series, LH series, and DLH series Open Web Steel Joists and Girders
3. SJI 200, the standard specification for CJ-series composite steel joists



Sprayed Fire-Resistant Materials (SFRM) Special Inspections

Section 1705.15 of Chapter 17 of the IBC code requires special inspections and tests of sprayed fire-resistant materials (SFRM) applied to floors, roof and wall assemblies, and structural members on all project work. Special inspections and tests shall be performed during construction with additional walk-through inspections before, during, and after the application of SFRM. Five basic physical and visual tests are provided to demonstrate compliance with the project fire-resistance design as denoted in the contract documents.

1. Condition of substrates
2. Thickness of application
3. Density in pounds per cubic foot
4. Bond strength (adhesion/cohesion)
5. Condition of finished application of SFRM

While most SFRM special inspection code acceptance criteria are listed in IBC Chapter 17, the special inspector must thoroughly review IBC Chapter 4 (Table 403.2.3) for code acceptance criteria (SFRM bond strengths) for high-rise buildings and other essential criteria. A review of IBC Chapter 6 (Table 601), which addresses fire-resistance rating for building elements, as well as IBC Chapter 7, Section 704, is also helpful in understanding SFRM applications, surface conditions, primers, encapsulants, and the IBC code's view of the manufacturer's installation instructions. The SFRM IBC code acceptance criteria utilize ASTM E605, "*Thickness and Density of SFRM*," and ASTM E736, "*Bond Strength Adhesion/Cohesion of SFRM*," as testing methods to determine compliance of the project SFRM with the applicable building code criteria.

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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