The Design Professional's Role in Special Inspections

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The National Council of Structural Engineers Associations (NCSEA) recently issued a position statement on special inspections clarifying their importance to protecting the public. One assertion made in this statement is that special inspections are "…essential for the satisfactory performance of any project." While many design professionals have a very clear understanding of the special inspection requirements of the *International Building Code* (IBC), there are also many that still do not understand the importance of Chapter 17 nor the role they play in ensuring adequate performance of special inspections. Regardless of how special inspections are locally enforced, the Structural Engineer of Record (SER) has some very specific duties in regards to the special inspection program. By adhering to the duties outlined in this article, you can help protect yourself from liability, provide a better product to the building owner, and provide an increased level of life safety.

Design Professional in Responsible Charge

While structural plans typically list the special inspection and testing requirements for structural components, who is responsible for specifying the special inspection requirements for the nonstructural items? Section 1704.3 of the IBC states that the "…design professional in responsible charge shall prepare a statement of special inspections." The "design professional in responsible charge" for these nonstructural components is often the architect, mechanical engineer, or other members of the design team.

The entire design team should coordinate the overall special inspection and testing requirements for every project. The next step is to compile these requirements into one project-specific Statement of Special Inspections (SSI). The SSI can be included in the construction documents or as a separate document to be submitted to the building official. There are some jurisdictions that now specifically require the SSI to be included on one of the first sheets of the construction documents, and require it to note clearly all structural and nonstructural items that require special inspections and tests.

Statement of Special Inspections (SSI)

As previously referenced, the design professional in responsible charge is required to provide an SSI for every project. The SSI provided on most projects is often missing many of the key components required by the IBC. Section 1704.3.1 of the IBC details the important requirements of an SSI. There are four key elements, described below.

1) Materials

Chapter 17 of the IBC divides the types of materials requiring special inspections or tests into 16 major categories. The material categories listed in the IBC include:

- Fabricators
- Steel Construction
- Concrete Construction
- Masonry Construction
- Wood Construction
- Soils
- Deep Foundations
- Wind Resistance
- Seismic Resistance Inspections
- Seismic Resistance Testing
- Sprayed Fire-Resistant Materials
- Intumescent Coatings
- EIFS
- Fire-Resistant Penetrations
- Smoke Control
- Special Cases

For clarification, this does not mean that only these items will require special inspections and tests. The last item, "special cases", is a catch-all category to cover items not specifically addressed. All items that are critical to life-safety and property protection, and require special expertise, require special inspections. Some specialty items that could also require special inspections and tests include deep excavation shoring, fiber-reinforced-polymer installations, etc.

2) Type & Extent of Inspections/Tests

Not only should the materials, as noted above, be listed in the SSI, but the type and extent of the inspections and tests should be clarified. The IBC provides several examples as shown in Table 1605.3, *Required Verification and Inspection of Concrete Construction*. Unfortunately, many design professionals rely too much on these IBC Tables and simply copy them to their general structural notes. With each new code cycle, more of these Tables from the IBC are now being removed. Instead, the actual special inspection and testing provisions are now simply referenced to the applicable design standard (i.e. AISC 360, AISC 341, TMS 402, etc.).

3) Seismic or Wind Requirements

Too often, the SSI provided for a specific project does not list the specific seismic- and wind-related special inspections and tests as outlined in Sections 1705.10 through 1705.12 of the 2012 IBC. In previous versions of the IBC, the wind and seismic requirements had

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separate sections within the code and were often overlooked. Now they are included specifically in Section 1705 as one of the 16 major categories noted previously. Each SSI should clearly define the specific wind and seismic requirements.

4) Inspection or Test Frequency

Since the term "Statement of Special Inspection" was added in the 2006 edition of the IBC, the requirement is to note specifically whether or not a particular special inspection or test is to be "continuously" or "periodically" performed. Terminology issues have become increasingly difficult now that referenced standards outline many of the special inspection requirements. Those standards, in some instances, do not use the same terminology as the IBC. Terminologies are clarified in the 2015 IBC, as it states, "…identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined." The SSI must list the frequency of the special inspections or tests to be performed, regardless of the term used.

The SSI should be Project-Specific

It is all too common for the SER to simply copy the special inspection tables from the IBC on their general structural note sheet and that is the extent of the SSI provided. The main problem with this practice is that the provisions laid out are not necessarily specific to the project in question. As an example, the plans may include Table 1705.7 of the IBC, which covers the special inspection requirements for driven deep foundation elements, yet the project in question does not include any deep foundations.

Section 107.2.1 of the IBC notes that the construction documents "shall be of sufficient clarity to indicate the location, nature and extent of the work." The SSI should not provide extraneous information. As an example, if IBC Table 1705.3 (*Required Verification and Inspection of Concrete Construction*) was included in its entirety yet prestressed concrete or shotcrete will not be provided, then the SSI is not limited to the project in question. The SSI must provide a clear message to the owner, contractor, design team, authority having jurisdiction, and to the special inspection agency as to what specific inspections and tests are required.

Oversight of Special Inspections

The IBC requires that special inspection and testing reports be submitted directly to the building official and directly to the design professional in responsible charge. It further states that discrepancies brought to the attention of the contractor, which are not corrected to-date, should be brought to the attention of both the building official and the design professional in responsible charge. This section highlights the key role that the SER has in ensuring the performance of special inspections, as required throughout the project. Not only should the SER be reviewing the special inspection reports to ensure construction of all items in accordance with the approved construction documents, but the SER should also be verifying inspections on all items which require inspections and testing and at the frequencies specified in the SSI.

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Performing Special Inspections

Section 1704.2.1 of the IBC states that the "…design professional in responsible charge… are permitted to act as the special inspector for the work designed by them, provided they qualify as special inspectors." While it is true that very few design professionals have the requisite experience and training to perform ultrasonic testing of demand critical welds, the SER would be the ideal person to perform visual inspections of structural components.

The October 2006 edition of *Civil + Structural Engineer* magazine included a feature article entitled "The Practice of Special Inspections" (Eych, et. al.). In this article, the author states, "There is probably no single act that an engineer can do that is as effective at reducing his or her liability exposure as performing inspections during construction."

This same article states, "It is not that the contractor (or *special inspector* [author comment]) is intentionally taking liberties with your design, but all of the tradesmen may not fully understand the subtleties of your drawings or your design intent." Too often we point the finger of blame to the contractor or special inspector for missing items, yet sometimes they honestly may not know the importance of a certain detail, and they do not have the understanding of how things are supposed to work together as does the SER.

The following experience highlights the importance of the SER on-site presence as much as possible, either as a special inspector or simply as a structural observer. A local building inspector was concerned about a pedestrian bridge that spanned between two buildings, even though special inspections had occurred throughout the installation of the bridge structure. Something did not seem right to the city inspector prodding them to spend some time looking at the bridge details on the approved construction documents. The plans clearly called for a slip connection between the bridge and one of the buildings. After climbing the scaffolding and taking a look beneath the bridge, it was apparent that the required slip connection was not provided (see *Figure*). While the support brackets were fabricated appropriately, with slots for the slip connection, the bracket was directly welded to the bridge structure, therefore creating a fixed connection.

Thank goodness for the city inspector and their inclination to take some extra time on this key detail. Even though special inspections occurred, the special inspector was more likely interested in ensuring that the weld was done correctly and not that the weld should never have been there in the first place. As this is a critical detail in the structural design, the SER would most likely have called it out to the contractor right away.

An article titled "Tornadoes Call QA-QC Into Question," *Engineering News Record* (ENR) (Parsons, February 2016), highlights another example. This article discusses recent damage reports from 12 tornadoes across North Texas that occurred during the afternoon of December 26, 2015. A total of 13 people died during the event, and over $1.2 billion in damage was estimated. After the event, one of the volunteer inspectors noted that there were improper foundation connections and that there were no visible roof attachments. The article also stated that "all exterior and interior wall construction was inspected and approved by a third-party inspection firm at numerous intervals throughout the construction process." This article highlights the need for the SER to take an active role as the special inspector whenever practical. The SER would more than likely take extra time to ensure that proper connections are provided on their projects, thus ensuring a complete load path is in place.

A pre-fabricated slot for a bolted slip connection. Note – just off the left edge of the photo are fillet welds of a bracket to the bridge structure.

Conclusion

The SER plays a key role in ensuring that special inspections and material testing are performed adequately on their projects. The SER works with the entire design team to create a detailed and project-specific SSI, providing oversight of the special inspection and testing reports provided during construction, and in performing special inspections and structural observations whenever possible. When the SER takes an active role in the special inspection program, they limit their liability, deliver a better product to the building owner, and ensure an increased level of life safety for the public.▪