

PROFESSIONAL ISSUES

issues affecting the structural engineering profession

Reinforcing Special Inspections

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Special Inspections have been part of our industry for decades, but are they as effective as they should be? While Special Inspection practices differ regionally, numerous professional organizations and individual state Structural Engineering Associations (SEA) agree that the Structural Engineer of Record (EOR/SER) should have a significant role in Special Inspections, and that structural inspections should be performed by or under the direct supervision of a licensed structural engineer. The reality, however, is that Special Inspections are often performed with minimal involvement and limited on-site presence from the EOR. The role of the EOR in Special Inspections in projects is inconsistent, and in some cases misunderstood. To make Special Inspections more effective, we should be cognizant of their background and intent, and we should educate owners and building officials

of the importance of having the EOR on-site and a licensed structural engineer performing critical inspections, particu-

larly of atypical and complex structural details (Figure 1).

Special Inspections Background and Intent

The expanded version of Special Inspections, similar to today's version, is based significantly on code provisions adopted following two particular events: the 1971 San Fernando, California, earthquake and the 1981 Hyatt Regency hotel walkway collapse in Kansas City, Missouri.

Special Inspections have been included in the Uniform Building Code (UBC) since its 1955 edition, but following the San Fernando earthquake, the Structural Engineers Association of California (SEAOC) was concerned that earthquake structural damage was partly the result of a lack of construction conformance with the structural design, and proposed language-strengthening inspection requirements that eventually shaped the inspection provisions of the 1976 edition of the UBC.

Following the walkway collapse at the Hyatt Regency hotel, the U.S. House of Representatives Subcommittee on Investigations and Oversight determined that one of the most critical problems associated with structural failures was the absence of the EOR on-site during construction. They recommended that professional organizations encourage code provisions requiring



Figure 1: Atypical Reinforcement Detail.

the structural engineer to be present on-site during construction. Shortly thereafter, the Building Officials & Code Administrators' (BOCA) National Code introduced Special Inspections requirements in its 1988 edition.

Role of the Structural Engineer in Special Inspections

Organizations such as the American Society of Civil Engineering (ASCE), the National Council of Structural Engineers Associations (NCSEA), and the Council of American Structural Engineers (CASE) encourage significant on-site presence of a licensed structural engineer. CASE's *Guide to Special Inspections and Quality Assurance* emphasizes the importance of having the Structural Engineer of Record, in particular, serve as the Special Inspector "wherever possible and practical." In the guideline's Position Statement, CASE points out that the "extensive on-site presence of the SER through the Special Inspections process is the best means to protect the public, control claims and losses, and improve the quality of the completed project." The authors further say that the "SER is the only member of the design team with the expertise and intimate knowledge of a particular building's Structural System and, therefore, is the best qualified to recognize and respond to site conditions that require the application of structural engineering judgment." ASCE's *Quality in the Constructed Project: A Guideline for Owners, Designers and Constructors* is a publication adopted in response to the Hyatt Regency hotel incident, and emphasizes the importance of the presence of the EOR on the job

site during construction to clarify structural design details and correct potential errors.

Individual member organizations of NCSEA have also weighed in on the role of the EOR. For example, the SEA of Kentucky states that the “Special Inspector of Record (SIR), ideally, shall be the Structural Engineer of Record (SER) who designed the building’s structural system(s).” Additionally, the Special Inspections/Quality Assurance Subcommittee of NCSEA was asked to author a paper on the role of the structural engineer in Special Inspections. The paper is intended to help the EOR with their development of, and participation in, Special Inspections.

Construction administration practices vary throughout the country, and there is also a difference of opinion about whether the EOR should perform Special Inspections or be limited to Structural Observations. There is, however, agreement on the need for significant on-site EOR involvement during construction. On the West coast, it is common for the Special Inspector to be a licensed engineer hired from a pre-approved list of firms who specialize in inspections. The EOR, or their directly supervised staff, performs periodic on-site Structural Observation of the work in progress. The intent is the same, that the EOR be aware of the construction work in progress and perform those steps necessary to assure quality either directly or with the assistance of outside inspection services.

The International Building Code (IBC) requires that the Registered Design Professional (RDP) in Responsible Charge prepare the Statement of Special Inspections, but the EOR, whether or not they are the RDP in Responsible Charge for the project, is often asked to write it. Among other things, the statement has to identify “materials, systems, components and work required to have special inspection or testing by the building official or by the registered design professional responsible for each portion of the work” and the type and extent of each special inspection and test. Chapter 17 does not address the inspection of deferred submittal items, and the EOR typically has to list the inspections required by deferred submittals before the specialty designers are on the project. Another Chapter 17 issue that EORs face is preparing the scope of inspections for the application of fire resistive materials. These issues continue to be debated by engineers, as many feel that the EOR should not be responsible for dictating the required tests and inspections of portions of work designed by other RDPs.

A common argument is that the statement should be a compilation of requirements from all of the RDPs with work to be inspected and/or tested.

Evolution of the Special Inspector

On-site Special Inspectors are not necessarily professional engineers (PE), and are often only supervised by an off-site PE. Many code-required special inspections can be properly performed by those without a PE, but a licensed engineer can more effectively inspect critical elements of the structure because he or she understands the intent of the details. Special Inspection provisions have been revised with each edition of the IBC, and although the role of the EOR has changed many times, the definition of Special Inspection remains unaltered: “Inspection as herein required of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.” The intent is clearly to emphasize that some structural components require



Figure 2: Slide-Bearing Connection for Seismic Movement Joint.

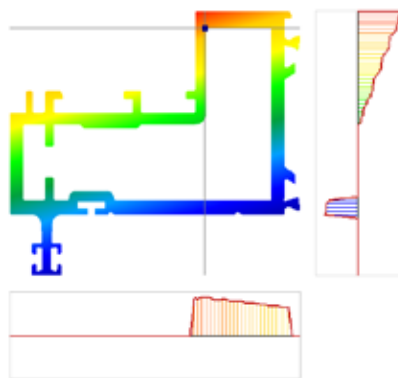
“special expertise” to inspect in the field. “Special expertise” is provided when licensed engineers provide on-site inspections. It is unlikely that the San Fernando earthquake and Hyatt Regency hotel incident-inspired Special Inspections recommendations were proposed with unlicensed on-site inspectors in mind.

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Figure 3: Unanticipated Slab Openings.

For proper inspection, it is critical to understand the intent and load path of complex structural details (Figure 2, page 9), and inspectors who are not PEs are not as likely to understand design intent. The EOR is best qualified to inspect the execution of the intent of their details, and he or she can also provide real-time response to conditions in the field, saving the owner valuable time. This avoids the typical lengthy process of the inspector having to send observed deficiencies through the owner, who corresponds with the architect, who finally corresponds with the EOR. The EOR reviews the condition remotely or during a site visit, and then communicates the resolution back through the channels to the field, meanwhile often delaying construction. Unless he is hired to perform special inspections, the EOR has a very limited role on-site, and therefore does not have as good an opportunity to catch any errors or omissions in the field. The more frequent on-site presence that the Special Inspector has allows more opportunity to identify potential issues that may compromise structural integrity. Items such as bundled sleeves or cores (Figure 3), unspecified beam or wall penetrations, unanticipated construction loads (Figure 4), and misinterpreted drawings are common issues, each of which are much more likely to be identified by a PE.

In recent years, some states have required greater EOR involvement than is required by the IBC, but the trend is now to allow RDPs to inspect projects that they did not necessarily design. Further, IBC 2009 clearly states that an RDP in responsible charge should submit the statement, but it is not uncommon for testing agencies who are not RDPs to be hired by owners to perform all testing and special inspections without assistance or guidance from an RDP. It is also common for state agencies to require that inspections be provided by contractors according to a scope of inspection listed in the technical specifications. New exceptions to the requirements for

the Statement of Special Inspections have even been introduced in Section 1704.1.1 of the IBC, allowing some structures to be permitted without a Statement.

In an effort to improve the quality of inspections, some SEAs suggest mandating inspection by licensed engineers. The SEA of Maine includes PE/Engineer-In-Training (EIT) requirements in their suggested Structural Schedule of Special Inspections, with final qualifications of Special Inspectors being subject to the discretion of the RDP preparing the schedule. The State of Florida requires that Special Inspectors meet qualification requirements of the Florida Board of Professional Engineers, and has a Special Inspector Application Form that requires the Special Inspector to be a professional engineer with “principal practice in structural engineering.”

Awareness of Code Requirements

Some states have had requirements for special inspections in their building codes for years but do not strictly enforce them. Many owners and building officials are aware of Special Inspections, but are not aware of the specific requirements outlined in Chapter 17 and of the Chapter 1 provisions of the code that list the roles and responsibilities of the EOR. Owners are often surprised when presented with a proposal for Special Inspection services, and some building officials often do not even request the required Statement of Special Inspections. EORs are constantly put in difficult situations regarding inspections. In many cases, the owner misunderstands the code and alleges that more frequent site visits are required under basic services. In other cases, Testing Agencies are hired as Special Inspector, but contractors request more frequent periodic



Figure 4: Unanticipated Construction Loads.

site visits from the EOR because they are not satisfied with the quality of the Testing Agency’s inspections. The Special Inspections Committee of the Structural Engineers of New Hampshire (SENH) recognized many of these problems, and prepared a document entitled *Special Inspection Questions & Answers* to assist professionals, owners, and building officials in understanding the code requirements for special inspections. Such documents are necessary, and should be widely circulated.

EORs often include a Structural Tests and Inspections Administration section in their design contract proposal. This is both to inform the architect and owner that special inspections are a code requirement and to ensure that, early in the project, owners are aware of the need to carry the cost of our involvement in their construction testing and inspection budget. Neglecting to educate or remind owners of special inspections requirements often leads to the owner seeing the inspections as an additional expense for which they have not allocated appropriate funds. There is no industry standard or method of documenting the EORs’ special inspections requirements in their contract documents, but it is becoming increasingly common and effective to see much of their Statement of Special Inspections duplicated on General Notes contract drawings or in a “Structural Tests and Inspections” Specification section. No matter the method used, most important is to make owners aware of the code requirements and the benefits of EOR involvement in their inspections programs. It has been 30 years since the Hyatt Regency disaster, and nearly as long since subsequent actions were taken by professional organizations to prevent such an event from occurring again. However, we can all still use a reminder of the intent and most effective ways to implement the special inspections program. ■