

Special Inspections for Wood Construction

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Introduction

The use of special inspections in the building codes is not new. Special inspections date back to the 1961 *Uniform Building Code (UBC)* published by the International Conference of Building Officials. At that time the *UBC* established a number of situations in which the employment of a special inspector was mandatory. An owner of a building was required to provide specially qualified inspectors or engineers to conduct continuous or periodic inspections during construction in addition to other mandatory inspections provided by the building department. Today, the *International Building Code (IBC)* continues this practice with criteria included in the 2006 *IBC* Chapter 17, titled Structural Tests and Special Inspections.

Background

The authority to enforce provisions contained in the building code for special inspections rests with the local building official. Since a building official certainly cannot be expected to be an expert on all technical building systems contained in a modern structure, inspectors are necessary who have “special” expertise to evaluate critical building components. Special inspectors report to the building official, but are engaged by the building owner or owner’s agent.

The purpose of special inspection is to provide additional evaluation above and beyond inspections normally performed by the building department in areas of construction where strength, safety, and construction practices have been determined by the building code, engineer, or architect of record, or the building official to be sufficiently critical to warrant a special inspector. A special inspector is an individual with specialized skills who observes critical building elements or structural features and provides reports to the building official.

Ensuring competence of the special inspector is the responsibility of the building official. Although the *IBC* lacks specific qualification requirements for special inspectors, this fact does not lessen the critical importance of the process of approving special inspectors. The building official ultimately has the responsibility to determine that special inspectors or inspection agencies are qualified to perform the specific type(s) of special inspection required.

As noted, building codes do not specifically state the requirements for special inspectors; however, guidelines for minimum qualifications are noted in the International Accreditation Service (IAS) acceptance criteria *AC291–Accreditation Criteria for IBC Special Inspection Agencies*. Generally, qualification as a special inspector or special inspection agency may include:

1. Maintaining current certification by ICC as a special inspector for the discipline(s) for which they are requesting approval,
2. Maintaining current accreditation as a special inspection agency by IAS with a scope of accreditation covering the discipline(s) for which the agency is requesting approval,
3. Written or oral examination to verify the applicant’s knowledge of jurisdictional procedures and code requirements.

Individuals may become certified through ICC by participating in a number of educational offerings such as seminars, training classes, or passing a written examination. Organizations which employ special inspectors and provide inspection services to the building industry can gain their accreditation through IAS, a subsidiary of ICC.

This article outlines areas of *IBC* Chapter 17 that pertain specifically to wood construction and discusses recent proposed changes to those provisions.

Fabricated Items

The scope of *IBC* Chapter 17 indicates that it “...shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.”

Further, under Section 1702.1, a fabricated item is defined as:

“FABRICATED ITEM. Structural, load-bearing or lateral load-resisting assemblies consisting of materials assembled prior to installation in a building or structure, or subjected to operations such as ... reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standard specifications referenced by this code, such as ... wood structural panels or in accordance with a standard, listed in Chapter 35, which provides

requirements for quality control done under the supervision of a third party quality control agency shall not be considered ‘fabricated items.’ ”

Special inspections are not required where the work is completed on the premises of a fabricator that is enrolled in a nationally accepted inspection program acceptable to the registered design professional in responsible charge. At completion of fabrication, the approved fabricator is required to submit a certificate of compliance to the building official and registered design professional in responsible charge stating that the work was completed in accordance with the approved construction documents.

Chapter 23 of the *IBC* covers wood design and construction. Section 2303 specifies the minimum standards and quality control procedures for various wood products. The following wood materials are outlined in Section 2303 (along with their manufacturing and quality control procedures) and, therefore do not require special inspections since they would not be considered a “fabricated item” per 1702.1:

- 2303.1.1 Lumber – DOC PS 20
- 2303.1.2 I-Joists – ASTM D 5055
- 2303.1.3 Glued laminated timber – AITC A190.1 and ASTM D 3737
- 2303.1.4 Wood structural panels – DOC PS 1 or PS 2
- 2303.1.5 Fiberboard – ASTM C 208
- 2303.1.6 Hardboard – AHA A135.6
- 2303.1.7 Particleboard – ANSI A208.1
- 2303.1.8 Preservative treated wood – AWPA Standards U1 and M4
- 2303.1.9 Structural composite lumber – ASTM D 5456
- 2303.1.10 Structural log members – ASTM D 3957
- 2303.1.11 Round timber poles and piles – ASTM D 3200 and ASTM D 25, respectively
- 2303.3 Hardwood plywood – HPVA HP-1
- 2303.4 Metal-plate connected wood trusses – ANSI/TPI 1

Special Inspections

IBC Section 1704 outlines requirements for special inspections. Recent changes approved during the ICC 2007/2008 Code Development Cycle clarify provisions of Section 1704 as shown in strikethrough/underline format below. The final action hearing to approve these changes will take place this fall in Minneapolis, Minnesota.

General qualifications for the special inspector as written in Section 1704.1 of the *IBC* are specified as follows:

“**1704.1 General** ...the owner or the registered design professional in responsible charge acting as the owner’s agent shall employ one or more ~~special inspectors~~ approved agencies or provide special inspection services to provide perform inspections during construction on the types of work listed under Section 1704...The special inspector shall be a qualified person who shall demonstrate competence, to the satis-

faction of the building official, for the inspection of the particular type of construction or operation requiring special inspection. The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as the approved agency and their personnel are permitted to inspect the work designed by them. The special inspector shall provide written documentation to the building official demonstrating their competence and relevant experience or training...”

As quoted above, the building codes do not specifically state how a special inspector is considered qualified nor how they demonstrate competence to the building official. These minimum qualifications are somewhat clarified in the guidelines for minimum qualifications as noted in *AC291*, but additional assistance can be found in other documents concerning special inspection as well.

The registered design professional in responsible charge is usually considered to be the most knowledgeable person when assuring conformance with the intent of the design as conveyed in the approved construction drawings and specifications. However, regardless of whether or not the design professional in responsible charge is hired as the special inspector on a project or not, it is essential that a registered design professional be sufficiently involved during the construction phase of the project to assure general conformance with the approved construction drawings. Courts have been ruling more frequently that the responsibility to verify conformance with the approved plans remain that of the registered design professional in responsible charge of the design regardless of the content included in the engineer’s contract for professional services. Generally, it is the opinion of most building officials that the increased involvement by the registered design professional in responsible charge during the construction process of a project will help facilitate early detection of code and structural problems which can be resolved much more easily when caught at an earlier stage of construction.

Per *IBC* Section 1704.1, the building official may waive requirements for special inspection of certain items that are considered to be of a minor nature. It is usually a requirement of the building department to have those areas of minor nature noted on the plans by the registered design professional in responsible charge. Special inspections are also not required for projects that by state statute do not require an architect or an engineer or for Group U occupancies that are accessory to R-3 occupancies.

Fabricator Inspection

Certain elements of wood construction, including fabrication of high-load diaphragms and structural wood construction, are subject to special inspection. Prefabricated wood structural elements are regulated through either inspection or through certification of the fabricators.

IBC Section 1704.2 includes requirements for fabricator special inspection. The special inspector is required to verify

that the fabricator maintains detailed fabrication and quality control procedures which provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved drawings, project specifications, and referenced standards. The special inspector is also required to review procedures relative to code requirements for the fabricator's scope of work. It is important to note that there is an exception provided for fabricators that adhere to written quality control and periodic auditing by an approved third party as follows:

“1704.2.2 Fabricator approval. Special inspections required by ~~this code~~ Section 1704 are not required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents.”

The word *approval* has special meaning in the *IBC*, referring specifically to the building official or authority having jurisdiction. No matter how well-implemented or effective the quality management system of a fabrication firm may appear, the *IBC* requires periodic verification. For example, if prefabricated wood members or assemblies are used for a project, a special inspector would be required to perform specific fabrication inspections. Quality control certification programs such as those implemented by APA-Engineered Wood Systems, Truss Plate Institute, American Institute of Timber Construction, IAS, etc., however, are covered under provisions specified in *IBC* Section 1704.2.2 for “fabricator approval.” These requirements include a comprehensive audit to stringent industry-specific performance criteria by trained auditors and industry professionals.

Special Inspection for Wood Construction

Section 1704.6 of the *IBC* provides general special inspection requirements for wood construction. The *IBC* does not contain any special inspection requirements for conventional woodframe construction. But, high-load diaphragms designed using the strength values from Table 2306.3.2.2 of the 2006 *IBC* must be installed using special inspections. For these systems, the special inspector must verify those areas specified in Section 1704.6.1.

“1704.6.1 High-load diaphragms. High-load diaphragms designed in accordance with Table 2306.3.2 shall be installed with special inspections as indicated in Section 1704.1. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved building plans. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diame-

ter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved building plans.”

Section 1707.3, for periodic special inspections in the 2006 *IBC*, has been clarified in those situations where woodframe construction consists of shear walls and diaphragms having a relatively low unit shear capacity. Periodic special inspection is required in seismic design categories (SDC) C-F of the wood lateral force-resisting system. Inspection is not required if shear walls have a fastener spacing of more than 4 in. on center (o.c.). Typically, the exception only applies to sheathing fastened at 6 in. o.c. since the nailing schedules provided in the code are provided for fastener spacing at 2, 3, 4, and 6 in. o.c., although an engineer could specify fastener spacing between 4 and 6 in. if required by calculation.

Recent changes approved during the ICC 2007/2008 Code Development Cycle incorporated new provisions in Section 1704.6.2 as follows:

1704.6.2 Metal plate connected wood trusses spanning 60 feet or greater. When a truss clear span is 60 feet or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

Special Inspections for Seismic Resistance

IBC Section 1707 includes provisions for special inspections for seismic-force-resisting systems in structures assigned to SDC C, D, E, or F as determined in *IBC* Section 1613. Extent and duration of special inspections and frequency of the special inspections must be clearly stated in the quality assurance plan. In some instances, the building code provisions allow periodic special inspection rather than continuous special inspection. Where periodic special inspections are permitted, the building codes do not specifically state requirements for the frequency of periodic inspection, but do indicate the stages of construction at which inspections are required for a particular category of work. The quality assurance plan should generally indicate the timing and extent of any periodic special inspections required by the building code.

Specific to wood construction, *IBC* Section 1707.3 requires the following:

1707.3 Structural wood. Continuous special inspection is required during field gluing operations of elements of the seismic-force-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

Exception: Special inspection is not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other

fastening to other components of the seismic-force-resisting system, where the fastener spacing of the sheathing is more than 4 inches on center.

The implied purpose of requirements for special seismic inspection is to provide additional public safety in higher seismic zones and assurance for the structural engineer of record that the structure is being built in accordance with design and performance specifications.

Structural Observations

Finally, *IBC* Section 1709 provides for structural observation by a registered design professional if the designer or building official deems it necessary. A structural observation is defined as a visual observation of the structural system by a registered design professional to verify general conformance of the work when compared to the approved construction documents. Typically, observation occurs during significant construction stages and at the completion of the structural system. Structural observation does not eliminate the requirements for any other inspection required by other provisions in the *IBC*.

The objective of the structural observation is to become familiar with the progress and quality of the contractor's work and then determine if the work is being completed in general conformance with the approved plans and specifications. Structural observations do not include any detailed inspections. The person completing the structural observation does not have responsibility for any acts or omissions of any contractor or any other entity providing materials or services on the project. Observation is a contract-negotiated activity which is usually performed by the structural engineer as a part of the normal scope of services. Structural observations are mandated for certain high wind or high seismic areas and for buildings in Occupancy Category III or IV in accordance with *IBC* Section 1604.5. The following report is required:

“At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer’s knowledge, have not been resolved.”

Example of a State Inspection Program

Development of the Lateral Wood Special Inspection (LWSI) registration program was initiated by the Washington Association of Building Officials (WABO) in early 2000. The first version employed the special inspection requirements in Chapter 17 of the *2003 IBC*. This program was a natural addition to WABO’s existing Special Inspection Registration Program (SIRP) which was already meeting other code-mandated needs for special inspections in Washington. Since that time, LWSI materials have been updated as new editions of the code are developed.

This program specifically targets critical building components in multi-story wood buildings that must be properly

installed to withstand seismic and high-wind events. These critical details in the lateral force resisting framing of wood buildings are beyond the normal scope of conventional framing inspections.

The program aids in the uniformity and quality of inspection procedures as well as inspector credentials. The developmental committee, consisting of code officials, engineers, and architects, provided:

- a 16-page business plan which also included the development, execution, and results of a feasibility survey of Washington State building department needs;
- test bank questions sufficient for two test administrations, including solutions and associated references;
- an index of individual test bank questions by sub-topic for easy sorts, ensuring consistent weighting of the subject matter for each test administration;
- a statistical analysis procedure for evaluating individual test question confidence levels (quality control);
- an 8-hour preparatory workshop for certification candidates, including handout materials and committee developed graphics.

Through this program, local building jurisdictions can easily ascertain and approve credentials of prospective special inspectors, which would otherwise be difficult to do on a consistent basis. The program also oversees and certifies quality control agencies where inspectors are employed. In addition, it provides a ready model for other states that desire to emulate a successful, proven program.

Responsibilities

The responsibilities of the LWSI inspector include:

General

- Responsibility and authority to carry out requirements of the enforcing jurisdiction.
- Notifying the jurisdiction about the type of inspection in accordance with jurisdiction requirements.
- Being present for continuous inspection during execution of all work for which the special inspector has been engaged.
- Verifying that the local jurisdiction inspectors have approved the conditions at the site when required.
- Submitting periodic written and verbal progress reports to the local jurisdiction as required.
- Notifying the contractor when discrepancies occur.
- Notifying the building official of uncorrected discrepancies, when they are not corrected.
- Verifying that structural plan changes are properly documented and approved by the enforcing jurisdiction.
- Maintaining records of work inspected, including discrepancies and actions taken.
- Submitting final compliance reports.

Technical

- Identifying lateral force resisting systems for conformance including shear walls, diaphragms, chords, sub-diaphragms, hold-downs, connectors, and drag struts.

- Verifying placement of plates, shear walls, diaphragms, squash blocks, hold-downs, strapping, beams, and columns.
- Verifying stud spacing, blocking, panel material and orientation, nail size and spacing, anchor bolt spacing, location, strap-size and location, and use of glue.

Material Identification

- Verifying wood species and grade, dimensions, sheathing material, and engineered lumber applications.
- Verifying fasteners including nails, staples, screws, and bolts for size, type, grade, and location.
- Verifying hardware, including hold-downs, straps, ties, rods, nuts, anchors, engineered systems, and prefabricated panel size types and location. Verifying that the hardware manufacturer is as specified. Reviewing and verifying manufacturer installation procedures.

Workmanship

- Verifying the proper use of materials including appropriate cutting, notching, nailing, and member alignment.
- Verifying material condition including member damage, shipping, handling, weather impacts, and hardware.
- Verifying any associated testing that should occur including pullout tests for epoxied anchor bolts.
- Reviewing plans for associated general requirements and details for foundations, connections, beams and columns, shear walls, and diaphragms.

Conclusion

Requirement for special inspections in the building codes have been mandated since 1961; however, special inspections pertaining to wood construction have only been required for the past two decades. Structural provisions in the building codes, including those for special inspection, have been impacted by natural disasters. Based on earthquakes, such as Loma Prieta (1989) and Northridge (1992), and hurricanes, such as Hugo (1989), Andrew (1992), and Charley (2004), special inspection provisions in the building codes have been revised to account for issues that were found during investigation of these events.

Certain types of wood construction require special inspections per *IBC* Chapter 17. Most commonly specified wood products have quality control and third-party auditing procedures in place that exempt the manufacturer from these additional requirements. High capacity (blocked) diaphragms and applications for certain high wind and high seismic zones, however, are the most common examples where special inspections for wood construction are required.

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