#### **CHAPTER 17**

# STRUCTURAL TESTS AND SPECIAL INSPECTIONS

#### SECTION 1701 GENERAL

**1701.1 Scope.** The provisions of this chapter 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.

**1701.2** New materials. New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

**1701.3 Used materials.** The use of second-hand materials that meet the minimum requirements of this code for new materials shall be permitted.

### SECTION 1702 DEFINITIONS

**1702.1 Definitions.** The following terms are defined in Chapter 2:

**APPROVED AGENCY.** [HCD 1 & HCD 2] "Approved agency" shall mean "Listing agency" and "Testing agency" (See Chapter 2 definitions).

APPROVED FABRICATOR.

CERTIFICATE OF COMPLIANCE.

DESIGNATED SEISMIC SYSTEM.

FABRICATED ITEM.

INSPECTION CERTIFICATE.

INTUMESCENT FIRE-RESISTANT COATINGS.

MAIN WINDFORCE-RESISTING SYSTEM.

MASTIC FIRE-RESISTANT COATINGS.

SPECIAL INSPECTION.

Continuous special inspection.

Periodic special inspection.

SPECIAL INSPECTOR.

SPRAYED FIRE-RESISTANT MATERIALS.

STRUCTURAL OBSERVATION.

#### SECTION 1703 APPROVALS

**1703.1 Approved agency.** An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements.

**1703.1.1 Independence.** An approved agency shall be objective, competent and independent from the contractor

responsible for the work being inspected. The agency shall also disclose possible conflicts of interest so that objectivity can be confirmed.

**1703.1.2 Equipment.** An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

**1703.1.3 Personnel.** An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.

**1703.2 Written approval.** Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

**1703.3 Approved record.** For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be open to public inspection at appropriate times.

**1703.4 Performance.** Specific information consisting of test reports conducted by an approved testing agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the material meets the applicable code requirements.

**1703.4.1 Research and investigation.** Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the applicant.

**1703.4.2 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**1703.5 Labeling.** Where materials or assemblies are required by this code to be labeled, such materials and assemblies shall be labeled by an approved agency in accordance with Section 1703. Products and materials required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703.5.1 through 1703.5.4.

**1703.5.1 Testing.** An approved agency shall test a representative sample of the product or material being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product or material is representative of the product or material tested.

1703.5.3 Label information. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or material's performance characteristics and approved agency's identification.

1703.5.4 Method of labeling. Information required to be permanently identified on the product shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

1703.6 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the applicant shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

1703.6.1 Follow-up inspection. The applicant shall provide for special inspections of fabricated items in accordance with Section 1704.2.5.

1703.6.2 Test and inspection records. Copies of necessary test and inspection records shall be filed with the building official.

## **SECTION 1704** SPECIAL INSPECTIONS, CONTRACTOR **RESPONSIBILITY AND STRUCTURAL OBSERVATIONS**

1704.1 General. This section provides minimum requirements for special inspections, the statement of special inspections, contractor responsibility and structural observations.

**1704.2 Special inspections.** Where application is made for construction as described in this section, the owner or the registered design professional in responsible charge acting as the owner's agent shall employ one or more approved agencies to perform inspections during construction on the types of work listed under Section 1705. These inspections are in addition to the inspections identified in Section 110.

#### **Exceptions:**

- 1. Special inspections are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
- 2. Unless otherwise required by the building official, special inspections are not required for Group U occupancies that are accessory to a residential occu-

- pancy including, but not limited to, those listed in Section 312.1.
- 3. Special inspections are not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.7 or the conventional light-frame construction provisions of Section 2308. [OSHPD 2] Not permitted by OSHPD.
- 4. [HCD 1] The provisions of Health and Safety Code Division 13, Part 6 and the California Code of Regulations, Title 25, Division 1, Chapter 3, commencing with Section 3000, shall apply to the construction and inspection of factory-built housing as defined in Health and Safety Code Section 19971.

1704.2.1 Special inspector qualifications. The special inspector shall provide written documentation to the building official demonstrating his or her competence and relevant experience or training. Experience or training shall be considered relevant when the documented experience or training is related in complexity to the same type of special inspection activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

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 act as the special inspector for the work designed by them, provided they qualify as special inspectors.

1704.2.2 Access for special inspection. The construction or work for which special inspection is required shall remain accessible and exposed for special inspection purposes until completion of the required special inspections.

1704.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections in accordance with Section 106.4, as a condition for permit issuance. This statement shall be in accordance with Section 1704.3.

Exception: A statement of special inspections is not required for portions of structures designed and constructed in accordance with the cold-formed steel lightframe construction provisions of Section 2211.7 or the conventional light-frame construction provisions of Section 2308.

1704.2.4 Report requirement. Special inspectors shall keep records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge. Reports shall indicate that work inspected was or was not completed in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a

point in time agreed upon prior to the start of work by the applicant and the building official.

**1704.2.5 Inspection of fabricators.** Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by this section and as required elsewhere in this code.

1704.2.5.1 Fabrication and implementation procedures. The special inspector shall verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards. The special inspector shall review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

**Exception:** Special inspections as required by Section 1704.2.5 shall not be required where the fabricator is approved in accordance with Section 1704.2.5.2.

1704.2.5.2 Fabricator approval. Special inspections required by Section 1705 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.

**1704.3 Statement of special inspections.** Where special inspection or testing is required by Section 1705, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

**Exception:** The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

**1704.3.1 Content of statement of special inspections.** The statement of special inspections shall identify the following:

- 1. The 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.
- 2. The type and extent of each special inspection.
- 3. The type and extent of each test.
- 4. Additional requirements for special inspection or testing for seismic or wind resistance as specified in Sections 1705.10, 1705.11 and 1705.12.

5. For each type of special inspection, identification as to whether it will be continuous special inspection or periodic special inspection.

**1704.3.2** Seismic requirements in the statement of special inspections. Where Section 1705.11 or 1705.12 specifies special inspection, testing or qualification for seismic resistance, the statement of special inspections shall identify the designated seismic systems and seismic forceresisting systems that are subject to special inspections.

**1704.3.3** Wind requirements in the statement of special inspections. Where Section 1705.10 specifies special inspection for wind requirements, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components subject to special inspection.

1704.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic forceresisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspection.

**1704.5 Structural observations.** Where required by the provisions of Section 1704.5.1 or 1704.5.2, the owner shall employ a structural observer to perform structural observations as defined in Section 1702. The structural observer shall be one of the following individuals:

- 1. The registered design professional responsible for the structural design, or
- 2. A registered design professional designated by the registered design professional responsible for the structural design.

Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations.

The owner or owner's representative shall coordinate and call a preconstruction meeting between the structural observer, contractors, affected subcontractors, and special inspectors. The structural observer shall preside over the meeting. The purpose of the meeting shall be to identify the major structural elements and connections that affect the vertical and lateral load-resisting systems of the structure and to review scheduling of the required observations. A record of the meeting shall be included in the report submitted to the Building Official.

Observed deficiencies shall be reported in writing to the owner or owner's representative, special inspector, contractor, and the Building Official. Upon the form prescribed by the Building Official, the structural observer shall submit to the Building Official a written statement at each significant construction stage stating that the site visits have been made and identifying any reported deficiencies which, to the best of the structural observer's knowledge, have not been resolved.

A final report by the structural observer which states that all observed deficiencies have been resolved is required before acceptance of the work by the Building Official.

**1704.5.1 Structural observations for seismic resistance.** Structural observations shall be provided for those structures assigned to Seismic Design Category D, E or F where one or more of the following conditions exist:

- The structure is classified as Risk Category III or IV in accordance with Table 1604.5.
- 2. The height of the structure is greater than 75 feet (22 860 mm) above the base.
- 3. The structure is classified as Risk Category I or II in accordance with Table 1604.5, and a lateral design is required for the structure or portion thereof.

**Exception:** One-story wood-framed Group R-3 and Group U occupancies less than 2,000 square feet in area, provided the adjacent grade is not steeper than 1 unit vertical in 10 units horizontal (10 percent sloped), assigned to Seismic Design Category D.

- 4. When so designated by the registered design professional responsible for the structural design.
- 5. When such observation is specifically required by the building official.

1704.5.2 Structural observations for wind requirements. Structural observations shall be provided for those structures sited where  $V_{asd}$  as determined in accordance with Section 1609.3.1 exceeds 110 mph (49 m/sec), where one or more of the following conditions exist:

- The structure is classified as Risk Category III or IV in accordance with Table 1604.5.
- 2. The building height of the structure is greater than 75 feet (22 860 mm).

- 3. When so designated by the registered design professional responsible for the structural design.
- 4. When such observation is specifically required by the building official.

# SECTION 1705 REQUIRED VERIFICATION AND INSPECTION

**1705.1 General.** Verification and inspection of elements of buildings and structures shall be as required by this section.

**1705.1.1 Special cases.** Special inspections shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

- Construction materials and systems that are alternatives to materials and systems prescribed by this code.
- 2. Unusual design applications of materials described in this code.
- 3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

**1705.2 Steel construction.** The special inspections for steel elements of buildings and structures shall be as required in this section.

**Exception:** Special inspection of the steel fabrication process shall not be required where the fabricator does not perform any welding, thermal cutting or heating operation of any kind as part of the fabrication process. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification, and grade for the main stress-carrying elements are capable of being determined. Mill test

TABLE 1705.2.2
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION OTHER THAN STRUCTURAL STEEL

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD <sup>a</sup>	
1. Material verification of cold-formed steel deck:			•	
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	_	X	Applicable ASTM material standards	
b. Manufacturer's certified test reports.	_	X		
2. Inspection of welding:				
a. Cold-formed steel deck:				
1) Floor and roof deck welds.	_	X	AWS D1.3	
b. Reinforcing steel:				
Verification of weldability of     reinforcing steel other than ASTM     A 706.	_	X	AWS D1.4 ACI 318: Section 3.5.2	
Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	X	_		
3) Shear reinforcement.	X	_		
4) Other reinforcing steel.	_	X		

For SI: 1 inch = 25.4 mm.

reports shall be identifiable to the main stress-carrying elements when required by the approved construction documents.

**1705.2.1 Structural steel.** Special inspection for structural steel shall be in accordance with the quality assurance inspection requirements of AISC 360.

**1705.2.2** Steel construction other than structural steel. Special inspection for steel construction other than structural steel shall be in accordance with Table 1705.2.2 and this section.

**1705.2.2.1 Welding.** Welding inspection and welding inspector qualification shall be in accordance with this section.

**1705.2.2.1.1** Cold-formed steel. Welding inspection and welding inspector qualification for cold-formed steel floor and roof decks shall be in accordance with AWS D1.3.

**1705.2.2.1.2 Reinforcing steel.** Welding inspection and welding inspector qualification for reinforcing steel shall be in accordance with AWS D1.4 and ACI 318.

**1705.2.2.2 Cold-formed steel trusses spanning 60 feet or greater.** Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss

TABLE 1705.3
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD <sup>a</sup>	IBC REFERENCE
Inspection of reinforcing steel, including prestressing tendons, and placement.	_	X	ACI 318: 3.5, 7.1-7.7	1910.4
2. Inspection of reinforcing steel welding in accordance with Table 1705.2.2, Item 2b.	_	_	AWS D1.4 ACI 318: 3.5.2	
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used.	-	X	ACI 318: D.9.2	1908.5
4. Inspection of anchors post-installed in hardened concrete members <sup>b</sup> .  a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.  b. Mechanical anchors and adhesive anchors not defined in 4.a.	X	X	ACI 318: D.9.2.4 ACI 318: D.9.2	
5. Verifying use of required design mix.		X	ACI 318: Ch. 4, 5.2-5.4	1904.2, 1910.2, 1910.3
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	_	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	1910.10
7. Inspection of concrete and shotcrete placement for proper application techniques.	X	_	ACI 318: 5.9, 5.10	1910.6, 1910.7, 1910.8
8. Inspection for maintenance of specified curing temperature and techniques.	_	X	ACI 318: 5.11-5.13	1910.9
9. Inspection of prestressed concrete:  a. Application of prestressing forces.  b. Grouting of bonded prestressing tendons in the seismic force-resisting system.	X X	_	ACI 318: 18.20 ACI 318: 18.18.4	_
10. Erection of precast concrete members.	_	X	ACI 318: Ch. 16	_
11. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	_	X	ACI 318: 6.2	_
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	_	Х	ACI 318: 6.1.1	_

For SI: 1 inch = 25.4 mm.

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a. Where applicable, see also Section 1705.11, Special inspections for seismic resistance.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with ACI 355.2, D.9.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design Across professional and shall be approved by the building official prior to the commencement of the work.

**1705.3 Concrete construction.** The special inspections and verifications for concrete construction shall be as required by this Section and Table 1705.3.

**Exception:** Special inspections shall not be required for:

- 1. Isolated spread concrete footings of buildings three stories or less above grade plane that are fully supported on earth or rock where the structural design of the footing is based on a specified compressive strength,  $f'_c$ , not greater than 2,500 pounds per square inch (psi) (17.2 MPa) regardless of the compressive strength specified in the construction documents or used in the footing construction.
- 2. Continuous concrete footings supporting walls of buildings three stories or less above grade plane that are fully supported on earth or rock where:
  - 2.1. The footings support walls of light-frame construction;
  - 2.2. The footings are designed in accordance with Table 1809.7; or
  - 2.3. The structural design of the footing is based on a specified compressive strength,  $f'_c$ , no greater than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the construction documents or used in the footing construction
- 3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
- 4. Concrete patios, and sidewalks, on grade.

**1705.3.1 Materials.** In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapter 3 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapter 3 of ACI 318. Weldability of reinforcement, except that which conforms to ASTM A 706, shall be determined in accordance with the requirements of Section 3.5.2 of ACI 318.

**1705.4 Masonry construction.** Masonry construction shall be inspected and verified in accordance with TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6 quality assurance program requirements.

**Exception:** Special inspections shall not be required for:

- 1. Empirically designed masonry, glass unit masonry or masonry veneer designed by Section 2109, 2110 or Chapter 14, respectively, where they are part of structures classified as Risk Category I, II or III in accordance with Section 1604.5.
- 2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
- 3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

1705.4.1 Empirically designed masonry, glass unit masonry and masonry veneer in Risk Category IV. The minimum special inspection program for empirically designed masonry, glass unit masonry or masonry veneer designed by Section 2109, 2110 or Chapter 14, respectively, in structures classified as Risk Category IV, in accordance with Section 1604.5, shall comply with TMS 402/ACI 530/ASCE 5 Level B Quality Assurance.

**1705.4.2 Vertical masonry foundation elements.** Special inspection shall be performed in accordance with Section 1705.4 for vertical masonry foundation elements.

**1705.5** Wood construction. Special inspections of the fabrication process of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704.2.5. Special inspections of site-built assemblies shall be in accordance with this section.

1705.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. 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 diameter 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.

**1705.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater.** Where a truss clear span is 60 feet (18 288 mm) 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.

1705.5.3 [OSHPD 2] Manufactured trusses and assemblies. The fabrication of trusses and other assemblages constructed using wood and metal members, or using light metal plate connectors, shall be continuously inspected by a qualified inspector approved by the enforcement agency. The inspector shall furnish the architect, structural engineer and the enforcement agency with a report that the lumber species, grades and moisture content; type of glue, temperature and gluing procedure; type of metal members and metal plate connectors; and the workmanship conform in every material respect with the duly approved plans and specifications. Each inspected truss shall be stamped by the inspector with an identifying mark.

**1705.6 Soils.** Special inspections for existing site soil conditions, fill placement and load-bearing requirements shall be as required by this section and Table 1705.6. The approved geotechnical report, and the construction documents prepared by the registered design professionals shall be used to determine compliance. During fill placement, the special inspector shall determine that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report.

**Exception:** Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.

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