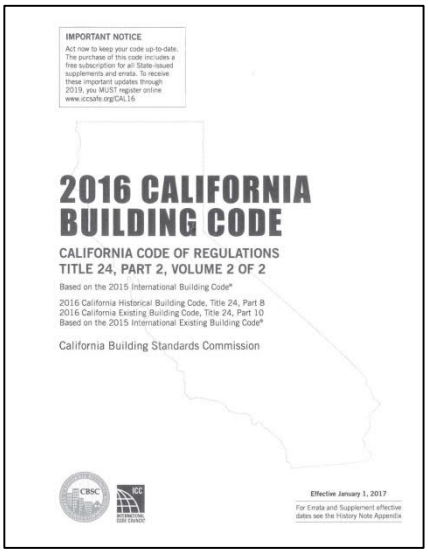
STRUCTURAL ENGINEERS ASSOCIATION OF NORTHERN CALIFORNIA

GUIDELINES
FOR
SPECIAL INSPECTION
AND
STRUCTURAL OBSERVATION

In Accordance with the 2016 CBC



Prepared by

SEAONC Construction Quality Assurance Committee
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Structural Engineers Association of Northern California

STRUCTURAL ENGINEERS ASSOCIATION OF NORTHERN CALIFORNIA

Guidelines for Special Inspection and Structural Observation In Accordance with the 2016 CBC

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GUIDELINES FOR SPECIAL INSPECTION AND STRUCTURAL OBSERVATION
In Accordance with the 2016 California Building Code

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GUIDELINES FOR SPECIAL INSPECTION AND STRUCTURAL OBSERVATION
In Accordance with the 2016 California Building Code

Preface

This document was developed by the Structural Engineers Association of Northern California (SEAONC) Construction Quality Assurance Committee. The purpose of this document is to provide guidance to structural engineers, special inspectors, agencies having jurisdiction, and others in the construction industry in the use and interpretation of the special inspection and testing provisions of the 2016 *California Building Code*, published by the State of California, Department of General Services, Building Standards Commission.

This document is an update to the *Guidelines for Special Inspection and Structural Observation in Accordance with the 2013 CBC*, developed by the SEAONC Construction Quality Assurance Committee.

Local building jurisdictions and State agencies may have additional special inspection and testing requirements that are not discussed in this document. The reader is urged to confirm the applicable special inspection and testing requirements with the building officials with jurisdiction over the specific project.

The suggestions, recommendations, and commentary discussed in this document are offered in an advisory capacity only and reflect the opinion solely of the authors. This document is not intended to define a standard of practice or to serve as a building code.

Introduction

Special inspection is the monitoring of materials and workmanship that are critical to the integrity of the building structure. It helps to provide some assurance that a project complies with the approved plans and specifications and relevant codes and ordinances. The special inspection process is required by the 2016 *California Building Code* (CBC) for most construction projects in addition to the inspections conducted by the building department.

Structural observation is the visual observation by a design professional of the structural system for general conformance with the approved plans and specifications. The 2016 CBC requires structural observation during construction of certain structures based on Risk Category, height, the level of seismic or wind-related risk, or as designated by the design professional.

The primary focus of these guidelines is to help design professionals comply with the code requirements as he/she prepares the Statement of Special Inspections (SSI) and the construction documents. In addition, these guidelines are concerned with how to use special inspection and structural observation to promote quality on the project.

The CBC requires a "Statement of Special Inspections", to be prepared by the registered design professional in responsible charge (RDPRC).

The RDPRC is identified in Section 107.3.4. of CBC Chapter 1 Division II and Chapter 2 Section 202 as the entity who duties include "…reviewing and coordinating submittal documents prepared by others.... for compatibility with the design of the building".

Section 107.3.4 requires that the project owner make this designation as part of the permit application. Thus, there is only one RDPRC for each project, and commonly the architect performs that role. Generally, there are other "registered design professionals" involved in a project, including the structural engineer, civil engineer, and mechanical, electrical and plumbing engineers. The structural engineer may assume the role of RDPRC on projects with little or no architectural elements or on seismic retrofit projects. There may also be projects where the civil, mechanical, or electrical engineer could assume the coordinating role.

In most cases, the architect, as the RDPRC, would be responsible for preparing the SSI based on the recommendations from the various consultants. The structural engineer should be the primary decision maker regarding the inspection and observation requirements for structural items involved and the structural anchorage of non-structural elements when they are part of the engineer's contractual scope of work.

This document is written assuming that the structural engineer responsible for the structural design is working closely with the architect acting as the RDPRC who coordinates the preparation of the statement of special inspections. It is also assumed that the structural engineer is involved in performing structural observations and monitoring the quality of the work. The "building official" (or the "jurisdiction") refers to the local building department and is the only enforcement entity referred to in these guidelines. Although much of the discussion herein could also apply to construction regulated by the Division of the State Architect (DSA) or the Office of Statewide Health Planning and Development (OSHPD), these guidelines do not specifically identify or discuss the different approaches of these agencies. These guidelines are written for the 2016 CBC.

Chapter 1 Special Inspection

Chapter 17 of the CBC 2016 contains the requirements for special inspection, testing, and structural observation for building construction projects. Because these guidelines focus on the special inspection and structural observation provisions of Chapter 17 the other provisions dealing with product qualification testing and labeling are discussed only briefly.

These guidelines also provide commentary of provisions in other chapters of the CBC and other referenced standards that have particular relevance to the content of Chapter 17.

"Special inspection" and "testing" associated with a construction project are distinct but inextricably related tasks. .

As a result, most agencies involved in special inspection also handle the sampling and testing of construction materials (such as concrete, masonry grout, reinforcing steel) and the non-destructive testing associated with welding inspection. Thus, references in these guidelines to "special inspection" are also intended to include the sampling and testing tasks.

This linkage is now reflected in the language of the code since as of the 2016 CBC the phrase "and tests" is associated with nearly all instances where "special inspections" are referenced.

Basis of Special Inspections and Tests

Special inspections and tests are performed based on the approved construction documents. This does not imply that other documents cannot be used to facilitate the inspections but the ultimate determination by the inspector on conformance or nonconformance of the work should be based on the approved construction documents. See the discussion in Section 3.2.4.

Deferred submittals such as truss design documents that are reviewed and approved by the building official should be considered approved construction documents and used by the special inspectors in determining if the work is in conformance.

Submittals by the contractor may be used by the special inspector to verify that the material incorporated in the work is the same material addressed by the submittal. For example, the heat number on the submitted steel mill report may be used by the inspectors to verify that the material being used is from the same heat.

Other Codes

California has adopted the California Residential Code (CRC) for detached one and two-family dwellings and townhouses not more than three stories high. The only specific special inspection invoked by the CRC is in CRC Section R109.1.5.2 which refers to CBC Chapter 17 for special inspections. It is unclear whether this means that the special inspection provisions apply in to all projects or whether this is only when the CBC in invoked. Section R606.3.5.1 requires special inspection during high lift grouting of masonry which is not a formal special inspection in the CBC although Level B and C masonry quality assurance provisions require inspection of grouting. This reflects a lack of coordination of the provisions in the several codes.

When aspects of the work fall outside the prescriptive provision of the CRC the CRC allows the use of the provisions in the CBC. When use is made of CBC provisions that would trigger any of the special inspections or tests required in Chapter 17, these special inspections and tests will be mandated along with the related requirements such as statements of special inspection and reporting.

The California Fire Code includes a reference to Section 1704 of the CBC. The detailed requirements for testing of smoke-controlled systems are now located in CBC Section 1705. This reference, while similar to the CRC, invokes the other provisions in Chapter 17 related to special inspections.

The California Green Building Standards Code also known as Part 11 of Title 24 CCR or the CALGreen Code has provisions for "Special Inspections". The "Special Inspection" provisions in CALGreen have not been coordinated with the Special Inspection requirements of the CBC and references by CALGreen to Special Inspections do not apply to the Special Inspection required by Chapter 17.

The following paragraphs present the 2016 edition of CBC Chapter 17 formatted with the CBC code language on the left, and our commentary on the right.

Where special inspection and testing requirements are now included only in referenced standards (such as AISC 360 - see the commentary for Section 1705.2.1,

the masonry code, and SDI QA/QC) those requirements are included, along with commentary.

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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.		This chapter covers special inspections and tests during construction as well as testing for product or material qualification. Other inspections performed by the building official are listed in Section 110 of CBC Chapter 1 Division II.
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.		The use of new materials, equipment, appliances, systems or methods of construction is governed by the provisions of Section 104.11 of CBC Chapter 1 Division II dealing with alternate methods of compliance. In many cases the manufacturers of these products or materials have obtained evaluation reports to assist in convincing the building official to approve the use of the product or material. An example of such a product would be shear panels used in wood construction.
SECTION 1702 DEFINITIONS		
1702.1 General. The following terms are defined in Chapter 2.		All definitions are located in Chapter 2.
SECTION 202 DEFINITIONS		Key definitions from Chapter 2 are provided.
APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests or furnishing inspection services, where such agency has been approved by the building official. *[HCD 1 & HCD 2] "Approved agency" shall mean "Listing agency" and "Testing agency".*		"Approved" always means "by the code official or the authority having jurisdiction". "HCD" is the Department of Housing and Community Development which has code adoption and primary enforcement authority for all residential projects in California but typically delegates code enforcement authority to local jurisdictions. The HCD maintains direct jurisdiction over factory-built housing in California and buildings in trailer parks.
APPROVED FABRICATOR. An established and qualified person, firm or corporation approved by the building official pursuant to Chapter 17 of this code.		See the discussion in Section 1704.2.5.1.
CERTIFICATE OF COMPLIANCE. A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents.		A certification should state specifically the standard with which the material, product or work complies. Mill certifications for reinforcing steel and weld filler metal certifications are examples of certificates of compliance.
DESIGNATED SEISMIC SYSTEM. Those non-structural components that require design in accordance with Chapter 13 of ASCE 7 and for which the component importance factor, Ip, is greater than 1 in accordance with Section 13.1.3 of ASCE 7.		Designated seismic systems include such non-structural items as egress stairs, fire-sprinkler systems, gas distribution piping systems (if required to remain functional after an earthquake), emergency generators and battery rack systems. Refer to Sections 1704.3.2, 1712.4, and 1713.3

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FABRICATED ITEM. Structural, load-bearing or lateral load-resisting members of assemblies consisting of materials assembled prior to installation in a building or structure or subjected to operations such as heat treatment, thermal cutting, cold working or reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standards referenced by this code, such as rolled structural steel shapes, steel reinforcing bars, masonry units and wood structural panels, or in accordance with a referenced standard that provides requirements for quality control done under the supervision of a third-party quality control agency are not "fabricated items."		The distinction between fabricated items and manufactured products is important. Special inspection of work performed in a fabricator's shop is required while special inspection of items produced using a manufacturing process is not required. The language is intended to clarify that structural elements such as steel joists, metal plate-connected wood trusses, wood I-joists, and glued-laminated timber are not to be considered fabricated items. Current practice typically is not to require project specific special inspection for these items unless specifically required by the owner, the design professionals, or the building official. The structural engineer should consider requiring some inspections where the complexity of the item, the method of fabrication, and the importance of the element to the structural system warrant extra scrutiny. Please see the commentary to Sections 1704.2.5, 1704.2.5.1, and 1705.5 for additional discussion on the inspection of fabricated items.
INTUMESCENT FIRE-RESISTANT COATINGS. Thin film liquid mixture applied to substrates by brush, roller, spray or trowel which expands into a protective foamed layer to provide fire resistant protection of the substrates when exposed to flame or intense heat.		The special inspection requirements for this material are included in Chapter 17 by reference to AWCI 12-B.
MAIN WINDFORCE-RESISTING SYSTEM. An assemblage of structural elements assigned to provide support and stability for the overall structure. The system generally receives wind loading from more than one surface.		There are additional special inspections associated with the main windforce-resisting system, as there are for the seismic load resisting system. These apply only where the wind speed V_{asd} is 110 mph or greater in Exposure Category B, and 120 mph or greater in Exposure Category C or D,, which within California occurs only in limited areas in Southern California. See Sections 1704.3.3 and 1705.11 for special inspection for the wind force system.
MASTIC FIRE-RESISTANT COATINGS. Liquid mixture applied to a substructure by brush, roller, spray or trowel that provides fire-resistant protection of a substrate when exposed to fire or intense heat.		The special inspection requirements for this material are included in Chapter 17 by reference to AWCI 12-B.
SPECIAL INSPECTION. Inspection of construction requiring the expertise of an *approved special inspector* in order to ensure compliance with this code and the *approved construction documents.*		Special inspection is distinct from the inspections performed by the jurisdiction's inspectors, structural observation, and other inspections required by the contract documents. It is distinct in that it is detailed and specific to items of work, is performed by agents of the owner and the results must be reported to the agency having jurisdiction.
Continuous special inspection. Special inspection by the *special inspector* who is present when and where the work to be inspected is being performed.		Continuous special inspection is required for such items as grouting of reinforced masonry, concrete placement, overhead adhesive anchors taking sustained tension and stressing of post-tensioning tendons.

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		It is generally applied to types of construction where process is important, and crucial elements of the work cannot be verified by the intermittent presence of the inspector or at a final inspection after completion of the work item. Continuous inspection is intended to provide a higher level of scrutiny than that provided by periodic inspection. It is not intended that every worker be continuously under the observation of a special inspector, but rather that each step of the work process is subject to the observation of an inspector. Depending on the type of the work, the size of the work area, and the number of workers involved in an activity requiring special inspection, one or more special inspectors may be needed. Special inspection requirements for steel construction and steel deck no longer use the terms "continuous" or periodic" to describe the frequency or intensity of the inspections. Refer to sections 1705.2.1 (the discussion under the AISC 360 N5.4) and 1705.2.2.
Periodic special inspection. Special inspection by the *special inspector* who is intermittently present where the work to be inspected has been or is being performed.		Periodic inspection is the term generally used when referring to inspections that are not continuous. The difficulty is that the exact nature of a periodic inspection varies depending on the particular items or system being inspected. The periodic inspection regime should allow the inspector to see all of the work but when this is not feasible the inspection effort should be essentially random so as not to create systematic blind spots. At the same time the inspectors should have a bias towards inspection those aspects of the work where quality has historically been problematic. Even if the inspections can be adequately performed at the completion of the work it is important for the inspectors to visit the work early in the process and periodically thereafter. This allows the inspector to gain a sense of the quality of the work allowing problems to hopefully be identified early. Where the quality of the construction is dependent on compliance with workmanship practices it is often not possible to determine compliance by looking at the completed work. When this is the case it is important for the inspectors to be present at the start of the work and for them to periodically visit the project so they can regularly observe the work being done. This will provide assurance that the workers are consistently complying with the workmanship requirements. The statement of special inspections or the project specifications should provide clarity regarding the nature

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		of the different types of periodic inspections. Detail on the nature of periodic inspections may not be required when the code provides clarity or when conventional inspection practices are well understood and deemed to be adequate.
SPECIAL INSPECTOR. A qualified person employed or retained by an *approved* agency and *approved* by the *building official* as having the competence necessary to inspect a particular type of construction requiring special inspection.		The building official is responsible for defining the qualifications of the special inspector. Many jurisdictions require that special inspectors be certified for the types of work they inspect by means of examinations given by ICC, AWS, ACI, or other organizations. Some also require documentation of relevant experience. Some states, state agencies, and cities maintain their own qualification programs in addition to or instead of other certifications.
SPRAYED FIRE-RESISTANT MATERIALS. Cementitious or fibrous materials that are spray applied to provide fire-resistant protection of the substrates.		Special inspection of spray applied fire proofing has been part of the *California Building Code* for many years. The details of the inspection are included in Section 1705.14.
STRUCTURAL OBSERVATION. The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents.		Chapter 2 of these guidelines provides a detailed discussion of structural observation.
SECTION 1703 **APPROVALS**		This section primarily deals with product approval issues including requirements for testing agencies involved in product approval. Code text and commentary is provided only for those provisions that directly impact the Owner's construction quality assurance activities.
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 specified in Sections 1703.1.1 through 1703.1.3. **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 to the building official and the registered design professional in responsible charge 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 special inspections.		This section establishes some of the information for approval of testing and inspection agencies by the building official. Refer to Section 1704.2.1 when the design professional will be performing special inspections. If the design professional is notified of potential conflicts of interest by a testing and inspection agency it is suggested that the design professional notify the Owner and let the Owner decide how to proceed.

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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 owner or the owner's authorized agent 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 report shall be approved by the building official. **1703.6.1 Follow-up inspection.** The owner or the owner's authorized agent shall provide for special inspections of prefabricated items in accordance with Section 1704.2.5. **1703.6.2 Test and inspection records.** Copies of necessary test and special inspection records shall be filed with the building official		These sections address such items as prefabricated wall assemblies, prefabricated buildings or modular units manufactured at offsite locations. It is not intended to apply to fabricated items or manufactured products (see discussion in Section 202 under "Fabricated Item"). Section 1703.6.1 makes it clear that special inspection is required for prefabricated assemblies, even though 1703.6 states that a "report" from the manufacturer is required. In California prefabricated residential units are permitted directly by HCD which deals with inspection in the fabrication plant. The local building department is only involved with the work that is done on site.
SECTION 1704 SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION		
1704.1 General. Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the building official and structural observations shall meet the applicable requirements of this section...		This section now makes reference to "submittals to the building official" – see the discussion of Section 1704.5.
1704.2 Special inspections and tests. Where application is made to the building official for construction as specified in Section 105, the owner or the owner's authorized agent, other than the contractor, shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705 and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are specified in Section 110,		This is the language that requires special inspection. It was significantly reworked for the 2016 CBC. The Owner (or the Owners agent) now has to identify the testing and inspection agencies that will be used on the project to the building official. This section makes it clear that the owner is responsible for special inspection and that it is not acceptable for the Contractor to be responsible for hiring special inspection activities.
Exceptions: 1. Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.		The building official will determine if the construction is "minor". The responsible design professional may submit documentation to the building official to substantiate the minor nature of such work.
2. Unless otherwise required by the building official, special inspections and tests are not required for Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.		This exception of Group U occupancies accessory to residential occupancies is consistent with the fact that many residential structures are regulated by the California Residential Code and thus are not subject to special

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		inspection.
3. Special inspections and tests 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.		It should be noted that Section 2211.7 is applicable only to certain low-rise residential buildings while the conventional construction provisions of Section 2308 could be used for certain low-rise non-residential buildings. This provision is duplicated in the exception to Section 1704.2.3
4. The contractor is permitted to employ the approved agencies where the contractor is also the owner.		This section was added to clarify the very particular case where the contractor and the owner are the same.
5. *[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.*		Factory built housing is regulated in California by HCD and the role of the local building department is in many instances limited to inspection of foundations and field connections.
1704.2.1 Special inspector qualifications. Prior to the start of the construction, the qualified agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspections and tests during construction. Experience or training shall be considered relevant where the documented experience or training is related in complexity to the same type of special inspection or testing 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 special inspectors for the work designed by them, provided they qualify as special inspectors.		The building official is responsible for defining the qualifications of the special inspector. Many jurisdictions require that special inspectors be certified for the types of work they inspect by means of examinations given by ICC, AWS, ACI, or other organizations. Some also require documentation of relevant experience. Some states, state agencies, and cities maintain their own qualification programs in addition to or instead of other certifications. The first paragraph expands on the criteria for the special inspector's qualifications. The second paragraph is an explicit statement that the engineer or architect responsible for the design of the work may perform special inspections of that work, provided they (or their employees designated by them to do the inspection) have the appropriate qualifications as determined by the building official. In California, special inspection is often performed by companies specializing in construction inspection, sampling, and testing, referred to herein as "inspection and testing agencies". Some jurisdictions, such as the City of Los Angeles, review, audit and approve individuals as special inspectors. The California Council of Testing and Inspection Agencies (CCTIA) has prepared "Guidelines for Special Inspection in Construction", which provides more detail on some common inspections and provides guidelines for issuing identification cards for special inspectors.

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1704.2.2 Access for special inspection. The construction or work for which special inspection or testing is required shall remain accessible and exposed for special inspection or testing purposes until completion of the required special inspections or tests.		This provision makes it explicit that construction must remain accessible and exposed for special inspection. Engineers should include this requirement in the construction documents so that it becomes the contractor's responsibility.
1704.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections in accordance with Section 107.1 Chapter 1, Division II, as a condition for permit issuance. This statement shall be in accordance with Section 1704.3.		This is the first reference to the statement of special inspections (SSI) in Chapter 17. See Chapter 5 of these guidelines for a detailed discussion of the statement of special inspections. The statement of special inspections (SSI) evolved from the "quality assurance plan" of earlier editions of the IBC. This was modeled on the quality assurance plan for seismic elements in the *NEHRP Recommended Provisions For New Buildings And Other Structures* (FEMA 368).
Exception: A statement of special inspections is 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.		As noted above (Section 1704.2, Exception 3), special inspection is not required for such structures, so an SSI is also not required. Section 2211.7 allows certain dwellings to be constructed in accordance with AISI S230
1704.2.4. Report requirement. Approved agencies shall keep records of special inspections and tests. The approved agency shall submit reports of special inspections and tests to the building official and to the registered design professional in responsible charge. Reports shall indicate that work inspected or tested 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 tests, and correction of any discrepancies noted in the inspections or tests shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official.		This is discussed in Chapter 4 of these guidelines.
1704.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspection of the fabricated items shall be performed during fabrication.		Special inspection of shop-fabricated items is required. Qualifying this statement is the definition of "fabricated item" in Section 202 which notes that certain items which are manufactured under a quality control plan are not considered fabricated items. This paragraph has been re-titled (previously "Inspection of fabricators") to make it clear that it is referring to inspection of the work, not inspection of the fabricator. The exceptions below and Section 1704.2.5.1 provide two slightly different ways for a fabricator to be approved and thus exempt from the inspection requirements.

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Exceptions: **1.** Special inspections during fabrication are not required where the fabricator maintains approved detailed fabrication and quality control procedures that provide a basis for control of the workmanship and the fabricator's ability to conform to approved construction documents and this code. Approval shall be based upon review of fabrication and quality control procedures and periodic inspection of fabrication practices by the building official.		This paragraph and Section have been revised to change the meaning completely. Formerly it required the special inspector to evaluate the fabrication and quality procedures of the fabricator. Now, this paragraph describes a way that fabricators can become exempt from special inspection, through building official review of the fabricator's quality control procedures coupled with what appears to be on-site inspection of the fabrication "practices" by the building official. This is similar, but distinct from the existing provisions for fabricator exemption from special inspections invoked by Exception 2 to 1704.2.5 and as further described in Section 1704.2.5.1 – please see discussion below.
2. Special inspections are not required where the fabricator is registered and approved in accordance with Section 1704.2.5.1.		Similar to Exception 1 above this section allows special inspection of fabricated items to be waived where the fabricator is "approved" although in this case the process involves review and auditing by an approved agency, not by the building official.
1704.2.5.1 Fabricator approval. Special inspections during fabrication 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 agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that the work was performed in accordance with the approved construction documents.		As always, "approved" means "by the building official" (Refer to definition of "Approved Fabricator" in Section 202). Thus, regardless of which method is used, the building official will ultimately determine if the requirements for approval have been met. It should never be assumed that a fabricator is approved even if the fabricator holds a certification from an industry group or an auditing agency. The applicable building official must sanction such certification. There are a number of recognized agencies that provide fabricator certification based on review and periodic auditing. Although some jurisdictions such as the City of Los Angeles actually audit and approve steel fabricators, most building departments do not have such resources and generally do not approve fabricators, even those with industry-group certification. It is the recommendation of the SEAONC CQA Committee that at least some special inspections be performed for critical or highly stressed components, when an approved fabricator is used. Since the code does not require the design professional's approval before a fabricator is designated as an approved fabricator the design professional should consider adding language in the specifications that would require special inspections of particular critical elements of work even when performed by approved fabricators.
1704.3 Statement of special inspections. Where special inspections or tests are required by Section 1705 the registered design professional in responsible charge shall prepare a statement of special inspections in accordance		Sections 1704.3 and 1704.3.1 describe who is responsible for the SSI and what the SSI needs to identify. The SSI is to include all the items that require special inspection as listed in Section 1705. This section

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with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.		describes who is responsible for the SSI and Section 1704.3.1 indicates what the SSI needs to identify. See Chapter 5 for a more detailed discussion of Section 1704.3 and the SSI, including SEAONC's model SSI.
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.		This allows the building official to permit somebody other than a design professional to prepare a statement of special inspection when a design professional is not associated with the project.
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 inspections or tests 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 inspections or tests for seismic or wind resistance as specified in Section 1705.11, 1705.12 and 1705.13. 5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the reference standard where the inspections are defined**.**		Item 1 indicates that, although the RDPRC is required to prepare the SSI, the selection of items required to be included and the specifics of the required inspections should be specified by the design professional responsible for the system or component (such as the architect, mechanical engineer, or structural engineer). The type and extent of special inspections and/or tests should be adequately identified in the SSI by a common name, reference to a specification section and/or referenced standard, and whether all or only a certain percentage of the work is affected. Item 5 requires that frequency or intensity of each special inspection be identified as "continuous" or "periodic", or that it be identified by the nomenclature used in the reference standard (such as AISC 341, AISC 360 , and SDI QAQC which use the terms "Observe" and "Perform".)
1704.3.2 Seismic requirements in the statement of special inspections. Where Section 1705.12 or 1705.13 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the designated seismic systems and seismic force- resisting systems that are subject to the *special inspections or tests*.		The statement of special inspections must identify the designated seismic systems as well as the building's seismic force-resisting systems that are subject to the seismic inspections and testing. This is done so that the special inspector, contractor, and building official are all aware which systems are subject to this special oversight. Note that the term "designated seismic systems" refers to architectural, electrical, and mechanical systems that are designated in Chapter 13 of ASCE 7. In practice it will typically be difficult to clearly identify the elements subject to seismic testing and inspection in the SSI. Thus, it is suggested that a general description be provided in the SSI and a reference to the drawings be provided where these elements can be more clearly identified. The architectural, mechanical and electrical systems that are subject to seismic testing and inspection, but that are not designated seismic systems, are not required to be identified in the SSI. However, the special inspections for these items are still required to be included in the statement of special inspections.

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1704.3.3 Wind requirements in the statement of special inspections. Where Section 1705.11 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to *special inspections.*		Similar to section 1704.3.2 for seismic, this section requires that the SSI identify elements that require special inspection for wind. Note that a distinction is made between the "main wind force-resisting system" (MWFRS) which includes diaphragms, frames and shear walls, and "wind resisting components" such as wall and roof cladding. Similar to Section1704.3.2 it will typically be difficult to clearly identify the elements subject to wind-triggered inspections in the SSI. A general description of the elements of the main wind force-resisting system and the wind-resisting components should be provided in the SSI and a reference be provided to the drawings where these elements can be more clearly identified. The Model Statement of Special Inspections in Appendix A includes a box to insert this statement.
1704.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic-force-resisting system, designated seismic system or a wind- or seismic force-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner or the owner's authorized agent 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 inspections.		The statement of contractor responsibility does not change the fact that the code looks to the Owner to comply with the code. The Contractor's responsibility for compliance with the construction documents is a result of the Owner-Contractor agreement. Thus if there are multiple prime contracts each of the prime contractors would need to provide a statement of responsibility. Building officials feel the acknowledgement by the contractor of his or her awareness of the special inspection requirements can help prevent the common problem of failure to have the specified special inspections performed.
1704.5 Submittals to the building official. In addition to the submittal of reports of special inspections and tests in accordance with Section 1704.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the building official for each of the following: 1. Certificates of compliance for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of a registered and approved fabricator in accordance with Section 1704.2.5.1. 2. Certificates of compliance for the seismic qualification of nonstructural components, supports and attachments in accordance with Section 1705.13.2. 3. Certificates of compliance for designated seismic systems in accordance with Section 1705.13.3. 4. Reports of preconstruction tests for shotcrete in accordance with Section 1908.5.		This new section is essentially a compilation of various new or pre-existing code requirements that certificates of compliance or material test reports be provided to the building official. Items 1 through 3, and Item 5 refer to certificates of compliance that have always been required to be provided to the building official. However, the test reports of Items 4, 6 and 7 (although not new to the Code) were not previously required to be submitted to the building official. This raises several questions: how will the building official use this information (are they expected to review and issue some sort of approval?); when should the submittals be submitted to the building official?; does this list include all such requirements in the code?; and, what is the role of the design professional in this (compile the information for submittal? Review the information first?) As Items 1 and 4 -7 are structural, the engineer will need to specify these submittals, and the RDPRC and/or the Owner are responsible for providing them to the building official. The appropriate design professional, such as the

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5. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207.5. 6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.5.4 of ACI 318 for reinforcing bars in concrete with a standard other than ASTM A706 that are to be welded; and **7.** Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A 615 and used to resist earthquake induced flexural and axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category B, C, D, E or F.		mechanical or electrical engineer should continue to manage the work associated with Items 2 and 3 (see the Commentary for Sections 1705.13.2 and 1705.13.3.) Building officials should develop appropriate policies for handling of these submittals. Items 2 and 3 have been required by ASCE 7 Section 13.2.2 as a submittal to the building official "after review and acceptance by a registered design professional" and have just been added to the referenced sections of the Chapter 17. Note that for Item 2, although this section requires submission of the certifications there is no corresponding requirement to verify that the product/system certified corresponds to that provided and that it was installed consistent with the certification. Language requiring a submittal of this report for shotcrete preconstruction test panels (Item 4) has just been added to Section 1908. In typical current practice, the engineer reviews the test panel report and accepts or rejects the use of shotcrete without the involvement of the building official. Similar to Item 4, the mill test reports of items 6 and 7 have always been required and reviewed and accepted by the engineer. The requirement to submit the reports to the building official is new.
1704.6 Structural observations		Structural Observations are discussed in Chapter 2 of these Guidelines.
SECTION 1705 **REQUIRED SPECIAL INSPECTIONS AND TESTS**		
1705.1 General. Special inspections and tests of elements and non-structural components of buildings and structures shall meet the applicable requirements of this section.		The provisions of 1705 apply to all construction not otherwise exempted from special inspection. The inspection and verification requirements are included in tabular form, occasionally augmented by narrative. Special inspections have been understood to only consist of those items listed in this chapter. There are no provisions for generic special inspections due to the need to define the nature and extent of the special inspection.
1705.1.1 Special cases. Special inspections and tests 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: 1. 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.		This section is intended to cover inspection of special conditions that are not otherwise covered in the Code. It is most commonly applied to inspection of load testing of specific materials and connections, such as steel moment frame connections that are not AISC pre-approved. It has also been applied to applications such as fiber reinforcement and underpinning. When the code is modified to address new products or materials they are no longer covered by this section. The use of these products is governed by CBC Section

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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.		104.11 which allows the use of the product when approved by the building official. The inspection and testing requirements are typically addressed in the resulting research report which the building official will typically require compliance with. The specific special inspections for these special cases should be listed in the statement of special inspections and detailed in the contract documents
110.3.8.1 Weather exposed balcony and walking surface waterproofing. [HCD 1, HCD 2] Where balcony or other elevated walking surfaces are exposed to water from direct or blowing rain, snow, or irrigation, and the structural framing is protected by an impervious moisture barrier, all elements of the impervious moisture barrier system shall not be concealed until inspected and approved. **Exception:** Where special inspections are provided in accordance with Section 1705.1.1, Item 3.		This emergency amendment to the California Building Code is included here because of the reference to Section 1705.1.1, Item 3. This exception allows the inspection to be performed as special inspection rather than by the building department. See the commentary associated with Section 1705.1.1 Item 3. As inspection of deck or balcony waterproofing systems is neither a typical jurisdiction inspection or a special inspection, the design professional should work with the building official to make sure that this critical inspection is covered.
1705.2 Steel construction. The special inspections and nondestructive testing of steel construction in buildings, structures, and portions thereof shall be in accordance with this section. **Exception:** Special inspections 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 reports shall be identifiable to the main stress-carrying elements when required by the approved construction documents.		Steel construction includes structural steel, cold-formed light-framed steel framing, and the use of steel joists (see CBC Chapter 22). The exception rarely applies to structural steel work in California. This section is more commonly used in the Eastern US where single and double angle bolted connections are more common. If the engineer wants to be able to track mill test reports to individual steel elements he or she will need to specifically note this requirement in the specifications.
1705.2.1 Structural steel. Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance inspection requirements of AISC 360. **Exception:** Special inspections of railing systems composed of structural steel elements shall be limited to welding inspections of welds at the base of cantilevered rail posts		The special inspection requirements for structural steel elements are defined in AISC 360-10 "Specification for Structural Steel Buildings" Chapter N, titled "Quality Control and Quality Assurance". Chapter N details the quality control and quality assurance verification, inspection, and testing requirements for structural steel construction. The use of the phrase "structural steel elements" is new to the 2016 CBC. As used here it means that these

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		inspections are not only applicable to steel that meets AISC's definition of "structural steel" but are required for any steel elements of a building that serve a structural role. Examples of this include a steel beam or steel angle used as a collector in a concrete building; steel fabrications used to connect timber framing, and steel stairs. The exception for railing systems was added as part of the code change that properly expanded the scope of the inspections for steel. The intent was to require the inspection only for the element most important to life safety – the welds of the railing posts. The quality assurance inspection requirements of Chapter N are the special inspection and testing requirements for the CBC while the quality control inspection requirements are the responsibility of the contractor. Following are selected provisions of AISC 360 Chapter N with commentary that helps to understand the Chapter N provisions in the context of the CBC. While these guidelines do not include commentary for all of Chapter N engineers should become familiar with all provisions in that Chapter.
AISC 360 N1. SCOPE Quality control (QC) as specified in this chapter shall be provided by the fabricator and erector. Quality assurance (QA) as specified in this chapter shall be provided by others when required by the authority having jurisdiction (AHJ), applicable building code (ABC), purchaser, owner, or engineer of record (EOR). Nondestructive testing (NDT) shall be performed by the agency or firm responsible for quality assurance, except as permitted in accordance with Section N7.		QA includes the special inspections and the nondestructive testing provided by the Owner. The actual inspection requirements for welding and bolting are included in two sets of three tables for prior to, during, and after welding or bolting.
AISC 360 N3.2 Available Documents for Steel Construction The following documents shall be available in electronic or printed form for review by the EOR or the EOR's designee prior to fabrication or erection, as applicable unless otherwise required in the contract documents to be submitted: (1) For main *structural steel* elements, copies of material test reports in accordance with Section A3.1. (2) For steel castings and forgings, copies of material test reports in accordance with Section A3.2. (3) For *fasteners*, copies of manufacturer's certifications in accordance with Section A3.3. (4) For deck fasteners, copies of manufacturer's product data sheets or catalog data. The data sheets shall describe the product, limitations of use, and recommended or typical installation instructions. (5) For anchor rods and threaded rods, copies of material test		Although the CBC code language that invokes the provisions of AISC Chapter N only refers to "special inspections and non-destructive testing", the quality assurance provisions of Chapter N go beyond inspection and testing. In general, only the specific requirements for special inspection, and non-destructive testing should be considered as code requirements. Engineers should be familiar with this list of documents to be made available by the contractor for review by the engineer and use by the special inspectors. Items (1) through (8) are the material certifications and test reports that are to be reviewed by the special inspector as part of the review specified in AISC 360 N5.2. Items (9) through (11) are addressed in the table for before welding. Items 12 and 13, which address the fabricator's or erector's

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reports in accordance with Section A3.4. (6) For welding consumables, copies of manufacturer's certifications in accordance with Section A3.5. (7) For headed stud anchors, copies of manufacturer's certifications in accordance with Section A3.6. (8) Manufacturer's product data sheets or catalog data for welding *filler metals* and fluxes to be used. The data sheets shall describe the product, limitations of use, recommended or typical welding parameters, and storage and exposure requirements, including baking, if applicable. (9) Welding procedure specifications (WPSs). (10) Procedure qualification records (PQRs) for WPSs that are not prequalified in accordance with AWS D1.1/D1.1M or AWS D1.3/D1.3M, as applicable. (11) Welding personnel performance qualification records (WPQR) and continuity records. (12) Fabricator's or erector's, as applicable, written quality control manual that shall include, as a minimum: (i) Material control procedures (ii) Inspection procedures (iii) Nonconformance procedures (13) Fabricator's or erector's, as applicable, QC inspector qualifications.		quality control procedures and personnel, are not actually of concern for the special inspector. However, engineers who recognize that construction quality assurance includes verifying the quality control effort may want to makes these items a required informational submittal.
AISC 360 N4.2 Quality Assurance Inspector Qualifications Quality assurance (QA) welding inspectors shall be qualified to the satisfaction of the QA agency's written practice, and in accordance with either of the following: (a) Welding inspectors (WIs) or senior welding inspectors (SWIs), as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors, except associate welding inspectors (AWIs) are permitted to be used under the direct supervision of WIs, who are on the premises and available when weld inspection is being conducted, or (b) Qualified under the provisions of AWS D1.1/D1.1M, subclause 6.1.4 QA bolting inspection personnel shall be qualified on the basis of documented training and experience in structural bolting inspection.		As the CBC is clear that the qualifications of special inspectors are set by the building official, these qualifications for welding inspectors are not actually binding on the building official. Building officials should consider using this information as a guide. It should be noted that AWS B5, and AWS D1.1 sub-clause 6.1.4 are less stringent than the requirements for a Certified Welding Inspector, under AWS QC1.
AISC 360 **N.4.3 NDT Personnel Qualifications** Nondestructive testing personnel, for NDT other than visual, shall be qualified in accordance with their employer's written practice, which shall meet or exceed the criteria of AWS D1.1/D1.1M Structural Welding Code—Steel, subclause 6.14.6, and: (a) American Society for Nondestructive Testing (ASNT) SNT-TC-1A, Recommended Practice for the		These qualifications are consistent with the requirements of the non-destructive testing industry.

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Qualification and Certification of Nondestructive Testing Personnel, or (b) ASNT CP-189, Standard for the Qualification and Certification of Nondestructive Testing Personnel.		
AISC 360 N5.2 Quality Assurance Quality assurance (QA) inspection of fabricated items shall be made at the fabricator's plant. The quality assurance inspector (QAI) shall schedule this work to minimize interruption to the work of the fabricator. QA inspection of the erected steel system shall be made at the project site. The QAI shall schedule this work to minimize interruption to the work of the erector. The QAI shall review the material test reports and certifications as listed in Section N3.2 for compliance with the construction documents. QA inspection tasks shall be performed by the QAI, in accordance with Sections N5.4, N5.6 and N5.7. Tasks in Tables N5.4-1 through N5.4-3 and N5.6-1 through N5.6-3 listed for QA are those inspections performed by the QAI to ensure that the work is performed in accordance with the construction documents. Concurrent with the submittal of such reports to the AHJ, EOR or owner, the QA agency shall submit to the fabricator and erector: (1) Inspection reports (2) Nondestructive testing reports		Where the engineer has reviewed the material test reports and certifications it is suggested that the special inspectors focus will be on verifying that the submitted test reports and certifications correspond to the material used. This is similar to the typical material verification practice that has always been associated with special inspection. The tasks listed in Tables N5.4-1 through N5.4-3 (welding inspection) and N5.6-1 through N5.6-3 (bolting inspection) and an excellent description of the inspection process. As the CBC only requires that special inspection and testing reports be submitted to the building official and registered design professional this requirement that the QA agency submit inspection and test reports to the fabricator and erector is not a code requirement.
AISC 360 N5.3 Coordinated Inspection "Where a task is noted to be performed by both QC and QA, it is permitted to coordinate the inspection function between the QCI and QAI so that the inspection functions are performed by only one party. Where QA relies upon inspection functions performed by QC, the approval of the engineer of record and the authority having jurisdiction is required".		When the special inspector is allowed to rely on tests and inspections performed by the Fabricator's inspectors it defeats the purpose of having the Owner hire the special inspector. Thus, it is suggested that since this conflicts with CBC Section 1704.2, which requires that the special inspector be hired by the Owner, that this section is not valid since the provisions in the CBC are controlling. It is suggested that this option not be allowed.
AISC 360 N5.4 Inspection of Welding Observation of welding operations and visual inspection of in-process and completed welds shall be the primary method to confirm that the materials, procedures and workmanship are in conformance with the construction documents. For structural steel, all provisions of AWS D1.1/D1.1M Structural Welding Code—Steel for statically loaded structures shall apply. As a minimum, welding inspection tasks shall be in		Neither AISC 360 nor AISC 341 use the terms "continuous" or "periodic" in describing the frequency or extent of the inspections. Instead the welding and bolting inspection tasks are identified in detail and the terms "Observe", and "Perform" are used to identify the inspection level for each task. The "Observe" level of inspection is assigned to nearly all of the inspection tasks before welding begins, and to all of the inspection tasks during welding. There is some

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accordance with Tables N5.4-1, N5.4-2 and N5.4-3. In these tables, the inspection tasks are as follows: O – Observe these items on a random basis. Operations need not be delayed pending these inspections. P – Perform these tasks for each welded joint or member.		ambiguity regarding the required frequency of the observations when AISC 360 applies. "Observe" means inspections occur "on a random basis" and is not more specific with respect to frequency. It is interesting that AWS D1.1 uses the words "suitable intervals" which may suggest that in some situations nonrandom intervals may be more appropriate, a point that the AISC Commentary appears to recognize. The "Perform" level of inspection is used when each weld, bolt or other item must be inspected. The definitions of Observe and Perform in AISC 360 Section N5.4 should be referenced to understand the intent of AISC. There is a concern that the definitions of "observe" and "perform" could result in less frequent inspection of items that were previously subject to continuous inspections. Engineers should consider adding supplemental language to their specifications for more critical welded joints. See also the discussion under 1705.11.1 for steel used in the seismic force-resisting system. Table N5.4-1 does not require the special inspector (QAI) to check welding equipment. In the past it was recommended that the inspectors check the welding equipment as a way to verify that it is operating in a way consistent with the appropriate welding procedure. Thus the structural engineer may desire to insert this as an added requirement.
AISC 360 N5.5a Nondestructive Testing of Welded Joints (partial) Ultrasonic testing (UT), magnetic particle testing (MT), penetrant testing (PT) and radiographic testing (RT), where required, shall be performed by QA in accordance with AWS D1.1/D1.1M. Acceptance criteria shall be in accordance with AWS D1.1/D1.1M for statically loaded structures, unless otherwise designated in the design drawings or project specifications.		Nondestructive testing (NDT) is to be performed as specified in AWS D1.1which has no specific NDT requirements for statically loaded structures. Sections N5.5b through N5.5g provide the detailed conditions for which NDT is required. . The AISC commentary to N5.5f suggests that a high rate of UT be performed at the start of the work to reduce the need for retesting if the welder has a high rate of rejects.
AISC 360 N5.5b CJP Groove Weld NDT For structures in Risk Category III or IV of Table 1.5-1, Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake and Ice Loads, of ASCE/SEI 7, Minimum Design Loads for Buildings and Other Structures, UT shall be performed by QA on all CJP groove welds subject to transversely applied tension loading in butt, T- and corner joints, in materials 5/16 in. (8 mm) thick or greater. For structures in Risk Category II, UT shall be performed by QA on 10% of CJP groove welds in butt, T- and corner joints subject to transversely applied tension		The rate of Ultrasonic Testing (UT) for groove welds (complete joint penetration welds) is based on the Risk Category, and the material thickness. For Risk Categories III and IV, 100% of groove welds require UT, in material greater than 5/16. For Risk Category II buildings, UT is only required for 10% of those groove welds. For structures that are in Risk Category I groove welds are not subject to NDT. When UT is not required for these structures the engineer may want to specify testing of CJP welds at critical

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loading, in materials 5/16 in. (8 mm) thick or greater.		elements.
AISC 360 N5.5c. Access Hole NDT Thermally cut surfaces of access holes shall be tested by QA using MT or PT, when the flange thickness exceeds 2 in. (50 mm) for rolled shapes, or when the web thickness exceeds 2 in. (50 mm) for built-up shapes. Any crack shall be deemed unacceptable regardless of size or location.		When requirements for NDT are based on material thickness engineers should specifically indicate which NDT tasks are applicable to their project, such as this requirement for testing for cracks at weld access holes.
AISC 360 N5.5d. Welded Joints Subjected to Fatigue When required by Appendix 3, Table A-3.1, welded joints requiring weld soundness to be established by radiographic or ultrasonic inspection shall be tested by QA as prescribed. Reduction in the rate of UT is prohibited.		If fatigue is a consideration the construction documents should make it clear to special inspectors that certain members are subjected to fatigue and thus the NDT must comply with the provisions of this section.
AISC 360 N5.5e. Reduction of Rate of Ultrasonic Testing The rate of UT is permitted to be reduced if approved by the EOR and the AHJ. Where the initial rate for UT is 100%, the NDT rate for an individual welder or welding operator is permitted to be reduced to 25%, provided the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, is demonstrated to be 5% or less of the welds tested for the welder or welding operator. A sampling of at least 40 completed welds for a job shall be made for such reduction evaluation. For evaluating the reject rate of continuous welds over 3 ft (1 m) in length where the effective throat is 1 in. (25 mm) or less, each 12 in. (300 mm) increment or fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 ft (1 m) in length where the effective throat is greater than 1 in. (25 mm), each 6 in. (150 mm) of length or fraction thereof shall be considered one weld.		The rate of UT may be reduced based on the reject rate of an individual welder working on a particular project.
AISC 360 N5.5f. Increase in Rate of Ultrasonic Testing For structures in Risk Category II, where the initial rate for UT is 10%, the NDT rate for an individual welder or welding operator shall be increased to 100% should the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, exceeds 5% of the welds tested for the welder or welding operator. A sampling of at least 20 completed welds for a job shall be made prior to implementing such an increase. When the reject rate for the welder or welding operator, after a sampling of at least 40 completed welds, has fallen to 5% or less, the rate of UT shall be returned to 10%. For evaluating the reject rate of continuous welds over 3 ft (1 m) in length where the effective throat is 1 in. (25 mm) or less, each 12-		The rate of UT must be increased for an individual welder when the reject rate is too high.

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in. (300 mm) increment or fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 ft (1 m) in length where the effective throat is greater than 1 in. (25 mm), each 6 in. (150 mm) of length or fraction thereof shall be considered one weld.		
AISC 360 N5.5g. Documentation All NDT performed shall be documented. For shop fabrication, the NDT report shall identify the tested weld by piece mark and location in the piece. For fieldwork, the NDT report shall identify the tested weld by location in the structure, piece mark, and location in the piece. When a weld is rejected on the basis of NDT, the NDT record shall indicate the location of the defect and the basis of rejection.		This is a good description of what should be included on a nondestructive testing report.
AISC 360 N5.6 Inspection of High Strength Bolting Observation of bolting operations shall be the primary method used to confirm that the materials, procedures and workmanship incorporated in construction are in conformance with the construction documents and the provisions of the RCSC Specification. (1) For snug-tight joints, pre-installation verification testing as specified in Table N5.6-1 and monitoring of the installation procedures as specified in Table N5.6-2 are not applicable. The QCI and QAI need not be present during the installation of fasteners in snug-tight joints. (2) For pretensioned joints and slip-critical joints, when the installer is using the turn-of-nut method with matchmarking techniques, the direct-tension-indicator method, or the twist-off-type tension control bolt method, monitoring of bolt pretensioning procedures shall be as specified in Table N5.6-2. The QCI and QAI need not be present during the installation of fasteners when these methods are used by the installer. (3) For pretensioned joints and slip-critical joints, when the installer is using the calibrated wrench method or the turn-of-nut method without matchmarking, monitoring of bolt pretensioning procedures shall be as specified in Table N5.6-2. The QCI and QAI shall be engaged in their assigned inspection duties during installation of fasteners when these methods are used by the installer. As a minimum, bolting inspection tasks shall be in accordance with Tables N5.6-1, N5.6-2 and N5.6-3. In these tables, the inspection tasks are as follows: O – Observe these items on a random basis. Operations need not be delayed pending these inspections.		Understanding these special inspection requirements requires an understanding of the RCSC standard. The AISC 360 commentary clarifies subsection (1) “Snug-tightened joints are required to be inspected to ensure that the proper fastener components are used and that the faying surfaces are brought into firm contact during installation of the bolts. The magnitude of the clamping force that exists in a snug-tightened joint is not a consideration and need not be verified”. According to the AISC 360 commentary the term “shall be engaged” in subsection (3) is intended to indicate a higher level of observation for the methods addressed there. It is not clear that is what the code requires.

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P – Perform these tasks for each bolted connection.		
AISC 360 N5.7 Other Inspection Tasks (partial) "The QAI shall be on the premises for inspection during the placement of anchor rods and other embedments supporting structural steel for compliance with the construction documents. As a minimum, the diameter, grade, type and length of the anchor rod or embedded item, and the extent or depth of embedment into the concrete, shall be verified prior to placement of concrete". "The QAI shall inspect the fabricated steel or erected steel frame, as appropriate, to verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection".		The QA inspection of the anchor rods and embedments prior to placement should be performed as required by Table 1705.3 Item 3. The model schedule of special inspections in Appendix A assumes that the concrete inspections related to embedments address the corresponding requirements of this section. It is assumed that the greater detail provided by this section reflects what is implied by Table 1705,3, The frame inspection is essentially the same as that which was required by Chapter 17 prior to the requirements moving to AISC 360. The special inspector (QAI) needs to verify the fabricated elements to provide assurance that the configuration of the steel and the details comply with the construction documents
AISC 360 N6 Minimum Requirements for Inspection of Composite Construction Inspection of structural steel and steel deck used in composite construction shall comply with the requirements of this Chapter. For welding of steel headed stud anchors, the provisions of AWS D1.1/D1.1M, Structural Welding Code—Steel, apply. (the remainder of N6 is not shown)		The inspection of steel deck welding and other fastenings are addressed both here as well as in the SDI QA/QC (see 1705.2.2). To resolve the duplication, it is proposed that this provision applies only to steel deck used in composite construction. .In both instances the underlying standard is AWS D 1.3 for welding inspection. As the language of 1705.2.1 only applies to structural steel elements which do not include cold formed steel elements such as steel deck, this portion of AISC 360 is considered to be only applicable to the installation of headed studs. Thus the inspection of steel decking welding is assumed to be addressed by the SDI provisions.
AISC 360 N7 Approved Fabricators and Erectors Quality assurance (QA) inspections, except nondestructive testing (NDT), may be waived when the work is performed in a fabricating shop or by an erector approved by the authority having jurisdiction (AHJ) to perform the work without QA. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. When the fabricator performs the NDT, the QA agency shall review the fabricator's NDT reports. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the AHJ stating that the materials supplied and work performed by the fabricator are in accordance with the construction documents. At completion of erection, the approved erector shall submit a certificate of compliance to the AHJ stating that the materials supplied and work performed by the erector are in accordance with the construction documents.		This provision parallels CBC Section 1704.2.5.1 but this section specifically makes it clear that NDT is still required for work performed by an "approved fabricator" This section allows the required NDT to be performed by the fabricator if approved by the building official and if the QA agency reviews the NDT reports. It is recommended that this option not be allowed since this is inconsistent with the special inspection provisions of the CBC.

CODE		COMMENTARY
AISC 360 N8. NONCONFORMING MATERIAL AND WORKMANSHIP Identification and rejection of material or workmanship that is not in conformance with the construction documents shall be permitted at any time during the progress of the work. However, this provision shall not relieve the owner or the inspector of the obligation for timely, in-sequence inspections. Nonconforming material and workmanship shall be brought to the immediate attention of the fabricator or erector, as applicable. Nonconforming material or workmanship shall be brought into conformance, or made suitable for its intended purpose as determined by the engineer of record. Concurrent with the submittal of such reports to the AHJ, EOR or owner, the QA agency shall submit to the fabricator and erector: (1) Nonconformance reports (2) Reports of repair, replacement or acceptance of nonconforming items		The reporting provisions in the CBC, specifically Section 1704.2.4, govern over this section. These particular provisions do however provide a framework for a communications protocol that could, during fabrication and erection, lead to improved quality.
1705.2.2 Cold-formed steel deck. Special inspection and qualification of welding special inspectors for cold-formed steel floor and roof deck shall be in accordance with the quality assurance inspection requirements of SDI QA/QC.		New to the 2016 CBC, the special inspection requirements for steel deck refer to the Steel Deck Institute's "Standard for Quality Control and Quality Assurance for Installation of Steel Deck" (SDI QA/QC). This document was modeled after Chapter N of AISC 360 and Chapter J of AISC 341. It covers material verification, qualifications of the special inspectors, and inspection of deck installation and fastening (both welding and mechanical fasteners). Like AISC 360 Chapter N, the inspection tasks are detailed in tables, (for deck placement, for welding, and for mechanical fastening) and the level of inspection for each task is listed as either Observe or Perform. The Observe level of inspection is better defined in SDI QA/QC: "Observe" shall mean to inspect these items on an intermittent basis. Operations need not be delayed pending these inspections. Frequency of observations shall be adequate to confirm that the work has been performed in accordance with the applicable documents. Unlike the code language invoking AISC 360 for steel construction, for steel deck this code specifically states that welding inspector qualifications shall be as detailed in SDI QA/QC. However, the required qualifications for inspectors for mechanical fastening are not specifically mentioned. Thus, while the provisions in SDI QA/QC should be used as a guide, the building official will determine the required

CODE		COMMENTARY
		qualifications of inspectors inspecting mechanical fasteners. Selected portions of SDI QA/QC are reproduced below with commentary.
SDI QA/QC 4.2-B. The QAI shall review the materials test reports and certifications listed in Section 2.2 for compliance with the construction documents.		The list of required test reports in Section 2.2 is very similar to that of Section 3.2 of AISC 360 Chapter N.
SDI QA/QC 6.1 The QAI shall perform the following verifications and inspections, as applicable. Acceptance shall be based on conformance with the construction documents. A. Verify deck materials are represented by appropriate mill certifications. B. Field welding of deck in accordance with AWS D1.3, SDI C, SDI NC, and SDI RD 7 C. Installation of mechanical fasteners in accordance with SDI C, SDI NC, SDI RD, and manufacturer's instructions. D. Steel deck installation in accordance with the construction documents, installation drawings, shop drawings, design documents and applicable referenced standards. E. Scope of inspections shall comply with SDI QA/QC Appendix 1 and the requirements of the AHJ.		Previously in the commentary to AISC 360 N6 (Ref Section 1705.2.1) it was noted that the AISC 360 inspection requirements for steel deck do not govern. Thus these provisions are the applicable provisions for special inspection of steel deck. . Item E: Edited versions of the tables in Appendix 1 are included below. The provisions related to Contractor QC are not included since they are perceived to not be a part of the special inspections addressed in the code.

CODE		COMMENTARY
1705.2.3 Open-web steel joists and joist girders. Special inspection of open-web steel joists and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705.2.3.		This new section provides for inspections of the installation of open-web steel joists and joist girders. Note that special inspection is not required for the manufacture of the members themselves.

Table 1705.2.3
REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS
(Table has been reformatted to accommodate Commentary)

Type	C	P	Ref. Std.	Commentary
1. Installation of open web steel joists and joist girders				
a. End connections – welding or bolted		X		This inspection should include verification of the

Table 1705.2.3 REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS (Table has been reformatted to accommodate Commentary)				
Type	C	P	Ref. Std.	Commentary
			SJI specs listed in Section 2207.1	connection details, welding inspection, and verification that bolts nuts and washers are of the specified type and installed in accordance with the drawings.
b. Bridging – horizontal or diagonal				
1. Standard bridging.		X	SJI specs listed in Section 2207.1	Inspections of the bridging should include verification of the member's type, size, and location, inspection of welding, and verification that any bolts, nuts and washers are of the specified type and installed in accordance with the drawings.
2. Bridging that differs from the SJI specifications listed in Section 2207.1		X		

CODE		COMMENTARY
1705.2.4 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 member restraint/bracing are installed in accordance with the approved truss submittal package.		This provision has to do with the installation of truss bracing and not the manufacturing of the truss members themselves. The reference to temporary bracing is relatively unique to the Code in that it addresses temporary elements that are not intended to remain after the completion of construction. Typically, the adequacy of temporary bracing of trusses is considered the contractor's responsibility as part of means and methods. However, for long span trusses the code now requires the special inspector to inspect the bracing and verify that the brace layout, alignment, and connections are in accordance with the truss design drawings. "Approved truss submittal" refers to a design-build or deferred approval submittal, reviewed by the building official, rather than to any review or approval by the structural engineer.
1705.3 Concrete construction. Special inspections and tests of concrete construction shall be performed in accordance with this section and Table 1705.3.		All of the specific verifications and inspections for concrete construction are shown in Table 1705.3. The narrative of Section 1705.3 focuses on the exceptions to special inspection. The 2016 CBC is based on ACI 318-14.

CODE		COMMENTARY
Exception: Special inspections and tests 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.		These exceptions are independent of the seismic design category or the load demand on the foundation. As inspection of anchor bolt placement and reinforcing steel is covered under this section, Exception 1, which could apply to a concrete, steel or masonry building, would allow construction without special inspection of any part of a footing for a moment frame, braced frame or shear wall, provided the footing was "isolated". This exception should be used with judgment. Grade plane is defined in Section 202 and is used to define the building height.
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. 2.3. The structural design of the footing is based on a specified compressive strength, $f'c$, not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the approved construction documents or used in the footing construction.		Exception 2 includes continuous footings for light frame construction, footings designed prescriptively, and footings designed with low concrete strength. The word "or" previously located at the end of Exception 2.2 has been deleted in the 2016 CBC. This means that the exception is applicable if any of the three conditions are met. Thus, a three-story wood-framed apartment building (not R-3) with multiple moment frames, braced frames, or highly-loaded shear walls and a specified concrete strength of 2500 psi would not trigger special inspection for the foundation concrete, reinforcing steel or anchor bolts. There are no additional special inspections for concrete construction based on seismic design category, other than enhanced verification of reinforcing steel. It may be wise then to specifically require special inspection for concrete construction where the seismic demand or consequence of failure is high, where the code would exempt such inspection.
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 foundation walls constructed in accordance with Table 1807.1.6.2. 5. Concrete patios, driveways and sidewalks, on grade.		
1705.3.1 Welding of reinforcing bars. Special inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.		AWS D1.4 is the reinforcing steel welding code. It requires visual welding inspection. If NDT is desired it must be specified.
1705.3.2 Material Tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.		This section applies only when there is a lack of information documenting compliance of materials with the standards listed in the code. This section and CBC Chapter 19, titled Concrete, refers directly to Chapter 19 and 20 of ACI 318 for information on material verification. However, these chapters of ACI 318 only identify required material standards and does not say

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		what "data or documentation" is required. Note that the material standards for cementitious materials are provided in Chapter 26. That information regarding documentation is found in the material standards themselves, such as ASTM A 615 for reinforcing steel, and ASTM C 150 for cement. Typical concrete specifications will require certification from the manufactures of cement, mineral admixtures, reinforcing steel, and prestressing steel, indicating that the tests required by the material standards have been made and that the material supplied meets the requirements.

Table 1705.3
Required Special Inspections and Tests of Concrete Construction
(Table has been reformatted to accommodate commentary)

Verification and Inspection	C	P	Ref Std.	IBC Section	Commentary
1. Inspection of reinforcement, including prestressing tendons, and verify placement	-	X	ACI 318: Ch. 20, 25.2,25.3, 26.6.1-26.6.3	1908.4	The ACI references are to the materials standards for steel used in concrete (Chapter 20) and to the details of bending, placing (including tolerances) and concrete cover (Ch 20 and Sections 25.2 and 25.3) . CBC Section 1908.4 has specific requirements related to bar sizes and placement requirements for shotcrete, particularly with respect to the use of non-contact lap splices. Inspection of the placement of reinforcing steel and prestressing tendons has always been a periodic inspection, usually with a final inspection prior to closing up of forms or delivery of concrete. For more complex, congested, and "penetrated" installations, more periodic inspections by the special inspector during tying of the rebar, and early involvement of the engineer can be very valuable.
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A 706. b. Inspect single-pass fillet welds, maximum 5/16"; and c. Inspect all other welds.	- X	X X -	AWS D1.4 ACI 318: 26.6.4		If bars other than ASTM A706 are to be welded, the inspection should include the review of mill certs to verify the assumptions used in the development of the welding procedure.
3. Inspect anchors cast in concrete.		X	ACI 318: 17.8.2		With the elimination of provisions for allowable stress design of anchorage all cast in place anchors are subject to special inspection. Note that this section does not apply to post-installed anchors which are addressed in item 4 of this table.

Table 1705.3
Required Special Inspections and Tests of Concrete Construction
(Table has been reformatted to accommodate commentary)

Verification and Inspection	C	P	Ref Std.	IBC Section	Commentary
4. Inspection of anchors post-installed in hardened concrete members 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 X	ACI 318: 17.8.2.4 ACI 318: 17.8.2		Footnote b of Table 1705.3 states that the special inspections for anchors are defined in the research report for the anchor and where there are no specific requirements the registered design professional shall provide the requirements The special inspection protocol for adhesive anchors is defined as part of the qualification process in ACI 355.4 and the protocol is communicated to the designer along with the other design criteria provided by ACI 355.4. ACI 355.4 Section 13.3.2.2 specifies the minimum elements that need to be included in a special inspection. In some situations the qualification of adhesive anchors may require continuous inspection even though Table 1705.3 may call for periodic inspection. When continuous inspection is specified, proof loading of anchors will be also required. ACI 355.4 Section 13.3.4 provides constraints on the proof load but the engineer still needs to specify magnitude and frequency of proof loading.
5. Verify use of required design mix.		X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3	Special inspection of concrete placement has long included verifying that the mix delivered to the site is the one specified for the specific location. The ACI and code sections referenced deal with concrete proportioning and have nothing to do with the special inspection required. Where concrete special inspection is required, at least one special inspector is on the site to sample the concrete and perform onsite tests (see below) and to observe concrete placement. Section 1904.1 states that structural concrete must be consistent with the durability requirements in ACI 318. The inspectors are often not in a position to make these evaluations. The reviewer is referred to SEAONC's "Guidelines for Reviewing Concrete Mix Designs in Accordance with the 2010 CBC" for a more detailed treatment of this and related issues. Given that Section 1904.2 deals with non-structural concrete it is not clear why this is listed since Section 1705.3 Exception 3 suggests that special inspection is not required for nonstructural slabs.
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content	X		ASTM C 172 ASTM C 31 ACI 318: 26.4,	1908.10	The CBC specifically requires the air-content test that has always been part of the requirements of

Table 1705.3
Required Special Inspections and Tests of Concrete Construction
(Table has been reformatted to accommodate commentary)

Verification and Inspection	C	P	Ref Std.	IBC Section	Commentary
tests and determine the temperature of the concrete.			26.12		ASTM C172 (sampling concrete). Where air content is not specified or not important, it is recommended that the air content test be waived, as it can require an additional special inspector. ASTM C 31 is the specification for casting concrete cylinders. It appears that in the 2018 IBC ACI 318 Sections 26.4.5 has been revised to refer to Sections 26.4. The requirements for performing concrete strength tests are noted in Section 26.12 of ACI 318 for cast-in-place concrete and Section 1908.10 for Shotcrete. It is recommended that the sampling and testing requirements be included in the statement of special inspections or in a separate schedule of structural testing as well as in the project specifications.
7. Inspect concrete and shotcrete placement for proper application techniques.	X		ACI 318: 26..5	1908.6, 1908.7, 1908.8	Placement inspection includes verifying the substrate for such conditions as frozen ground, loose soil in the bottom of footings, water or debris in forms; verifying methods of conveying and depositing the concrete; and verifying consolidation. For shotcrete (reference Section 1908), placement inspection should include verification of the nozzle operator's technique for encasing reinforcing, the use of a blow-pipe to remove rebound, and preparation of joints. ACI 318 does not explicitly cover shotcrete, and the CBC does not include the ACI guides or specifications for shotcrete as Referenced Standards. It is recommended that project specifications make use of ACI 506, *Guide to Shotcrete*.
8. Verify maintenance of specified curing temperature and techniques.		X	ACI 318: 26.5.3-26.5.5	1908.9	The special inspector should observe the initial application of the specified curing method, periodically verify that the curing is maintained, and report curing that does not meet the specifications as non-compliant.
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	X X		ACI 318: 26.10		Inspection of tendon grouting in bonded systems is only required for elements of the seismic-force-resisting system.
10. Inspect erection of precast concrete members.		X	ACI 318: Ch 26.9		It is recommended that this inspection focus on the bearing and connection details, and include inspection of welding, bolting, or other anchorage

Table 1705.3
Required Special Inspections and Tests of Concrete Construction
(Table has been reformatted to accommodate commentary)

Verification and Inspection	C	P	Ref Std.	IBC Section	Commentary
					requirements.
11. Verify 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: 26.11.2		Normally considered as part of the contractor's (and the contractor's engineer's) means and methods, this strength testing is a special inspection item and thus the owner's responsibility.
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.		X	ACI 318: 26.11.1.2(b)		This verification of member sizes and dimensions is generally performed as part of inspection of reinforcing steel. The code language very specifically limits the inspection to location and dimensions only – support and bracing of the forms is not part of the inspection.

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1705.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6.		The detailed masonry special inspection requirements have been moved to TMS 402/ACI 530/ASCE 5 ("the masonry code") and TMS 602/ACI 530.1/ASCE 6 ("masonry specifications"). For brevity and clarity these documents will generally be referred to as TMS 402 and TMS 602. Inspections in the QA provisions of these standards, Section 3.1 of the masonry code and Section 1.6 of the masonry specification, are considered to be special inspections. . The design professional must specify the level of quality assurance (B and C) in accordance with Section 3.1 of the masonry code. Note that the nomenclature to define the level of quality assurance has changed. The tables of detailed inspections in TMS 602 and TMS 402 are the same. Risk Category rather than seismic design category is considered in determining the level of inspection under this section. Risk Categories are defined in Table 1604.5 and are required by Section 1603.1.5 to be shown on the Construction documents. A simplified summary of the Risk Categories follows. Risk Category I: Agricultural/minor storage buildings Risk Category II Most buildings Risk Category III Assembly, some schools, high occupant load Risk Category IV Essential and hazardous buildings INSPECTION LEVEL SCHEDULE

Design Type	Risk Category	Inspection Level
Empirical/Glass/Veneer	I, II, III	Exception 1

CODE		COMMENTARY
		<table><tr><td></td><td></td><td></td></tr><tr><td>Empirical/Glass/Veneer</td><td>IV</td><td>Level B</td></tr><tr><td>Engineered</td><td>I, II, III</td><td>Level B</td></tr><tr><td>Engineered</td><td>IV</td><td>Level C</td></tr></table> The Level B and Level C Quality Assurance Tables from TMS 402 have been included below In addition comments on selected provisions from TMS 402 have been included in these guidelines. CBC Section 2101.3 includes a provision that allows as an alternate an itemized testing and inspection program that meets or exceeds the requirements of Chapter 17
Exception: Special inspections and tests shall not be required for: 1. Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category I, II or III. 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.		The exceptions are for conservatively designed masonry such as empirically designed masonry, prescriptively-designed veneer, masonry foundation walls designed from the tables in Chapter 18, and prescriptively-designed fireplaces and chimneys. Because of Exception #1 it does not appear that Level A Quality Assurance provisions are ever invoked.
1705.4.1 Empirically designed masonry, glass unit masonry and masonry veneer in Risk Category IV. Special inspections and tests for empirically designed masonry, glass unit masonry or masonry veneer designed by Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV, shall be performed in accordance with TMS 402/ACI 530/ASCE 5 Level B Quality Assurance .		CBC Section 2109.1.1 titled "Limitations" states that empirical design of masonry is not allowed when one or more of the limitations in Appendix A of TMS 402 apply. In this appendix empirical design of masonry is not allowed in Seismic Design Categories D, E, and F. In addition, Appendix A further limits the use of empirical design in SDCs B and C to members that are not a part of the seismic force resisting systems. This effectively prohibits the use of empirical design in California.
1705.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705.4.		This means that if masonry is used in a foundation element it will be inspected as any other masonry element with the exception noted in Exception 2 of Section 1705.4.
TMS 402 3.1 *Quality Assurance program* The quality assurance program shall comply with the requirements of this section, depending on the Risk Category, as defined in ASCE 7 or the legally adopted building code. The quality assurance program shall itemize the requirements for verifying conformance of the material composition, quality , storage , handling, preparation, and placement with the requirements of TMS 602/ACI 530.1/ASCE 6.		The quality assurance program in TMS 402 and TMS 602 is satisfied by the special inspection program and the Statement of Special Inspection required by Chapter 17 of the CBC. The Statement of Special Inspections along with the specifications provide the detail to satisfy the need to itemize the requirements. This interpretation is supported by CBC Section 2105.1 where it says that the quality assurance program required by that

CODE		COMMENTARY
		section shall comply with the inspection and testing requirements of Chapter 17
TMS 402 3.1.2 *Level B Quality Assurance* **3.1.2.1** The minimum quality assurance program for masonry in Risk Category IV structures and designed in accordance with Chapter 12 or 13 shall comply with Table 3.1.2 **3.1.2.2** The minimum quality assurance program for masonry in Risk Category I, II, or III structures and designed in accordance with chapters other than those in Part 4 or Appendix Ashall comply with Table 3.1.2.		Since the detailed masonry inspection requirements have been moved to TMS 402 and TMS 602 these guidelines now address portions of the referenced masonry standards. Chapters 12 and 13 deal with empirical designed masonry, glass masonry and masonry veneer. TMS 402 Table 3.1.2 is the same as Table 4 in TMS 602

CODE					COMMENTARY
TMS 402 – Table 3.1.2 **TMS 602 - Table 4 Level B Quality Assurance** **(Table has been reformatted to accommodate commentary)**					
MINIMUM TESTS					
Verification of slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with Article 1.5.B.1.b.3 for self-consolidating grout.					Consistency and flowability of self-consolidating concrete and grout are measured differently from conventional concrete and grout.
Verification of f'_m and f'_{AAC} in accordance with Article 1.4.B prior to construction, except where specifically exempted by the Code.					f'_m and f'_{AAC} (for aerated autoclaved masonry) need to be verified prior to construction (by testing of units and grout, or by prism testing) as well as during construction.
MINIMUM INSPECTION					
Inspection Task	Freq.		Reference. for Criteria		Commentary
	C	P	TMS 402 ACI 530 ASCE 5	TMS 602 ACI 530.1 ASCE 6	
1. Verify compliance with the approved submittals		X		Art. 1.5	The use of the word “approved” in the QA requirements is not consistent with the building code’s definition wherein “approved” means approved by the building official. In this context, the assumed intent is that the inspector should make use of the submittals reviewed and accepted by the engineer. The problem is that the requirement as written does not define what is expected to be done to verify compliance. Verifying compliance with the submittals is at odds with the general CBC requirement that the work needs to comply with the approved construction documents and not submittals

CODE					COMMENTARY
TMS 402 – Table 3.1.2 TMS 602 - Table 4 Level B Quality Assurance (Table has been reformatted to accommodate commentary)					
MINIMUM TESTS					
					which may vary from the construction documents. Many Owner Contractor contracts similarly require compliance with the contract documents and not the shop drawings.
2. As masonry construction begins verify the following are in compliance:					These tasks are generally interpreted to refer to initial inspections sufficient to verify that the contractor is following the contract documents.
a. Proportions of site-prepared mortar		X		Art. 2.1, 2.6A	The manner in which mortar proportions are measured and controlled at the site is important. There are actually no code requirements for sampling mortar for strength testing. Mortar is however routinely sampled and tested.
b. Construction of mortar joints		X		Art. 3.3B	Note that this inspection is required only at the beginning of laying masonry. Thus inspection of lay-up of all courses of masonry is not required.
c. Grade and size of prestressing tendons and anchorages		X		Art, 2.4B, 2.4H	This inspection language focuses on the material rather than the placement addressed below.
d. Location of reinforcement, connectors, and prestressing tendons and anchorages		X		Art. 3.4, 3.6A	Depending on the reinforcement pattern and the kind of masonry being constructed, the inspector may need to be on the site nearly continuously in order to be able to reliably inspect the reinforcement within a masonry wall. The referenced Articles from the masonry specification give detailed placement tolerances.
e. Prestressing technique		X		Art. 3.6B	Prestressing inspection for masonry is very similar to that for concrete. The inspection of “prestressing technique” is apparently the same inspection as the “application and measurement of prestressing force” in 4e below.
f. Properties of thin-bed mortar for AAC masonry	X	X		Art. 2.1 C	The footnotes to the table make it clear that continuous inspection is required for the first 5000 square feet of AAC masonry. Subsequent AAC masonry is subject to periodic inspection.
3. Prior to grouting, verify the following are in compliance:					Since these inspections prior to grouting are listed as periodic, it is assumed that the inspections can take place after the wall is up to the height of the grout pour.
a. Grout space		X		Art. 3.2D, 3.2F	The inspection should take place prior to closing of any cleanouts at the bottom of grout

CODE					COMMENTARY
TMS 402 – Table 3.1.2 TMS 602 - Table 4 Level B Quality Assurance (Table has been reformatted to accommodate commentary)					
MINIMUM TESTS					
					lifts.
b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons, and anchorages		X	Sec 6.1	Art. 2.4, 3.4	This reinforcement inspection language focuses on the material rather than the placement of 2d above.
c. Placement of reinforcement, connectors, and prestressing tendons and anchorages.	`	X	Sec. 6.1, 6.2.1, 6.2.6, 6.2.7	Art. 3.2E, 3.4, 3.6A	Reinforcement placement is also to be inspected periodically during wall lay-up.
d. Proportions of site-prepared grout and prestressing grout for bonded tendons.		X		Art. 2.6B, 2.4G.1.b	Most grout for reinforced masonry in California is ready-mix. The reference in the masonry specification simply points to ASTM C 476 for grout proportions. The special inspector should verify that the proper grout mix design is used for grout that is not site prepared.
e. Construction of mortar joints		X		Art. 3.3B	This second inspection of the mortar joints is to ensure that the joints are sound and able to resist the pressure from the wet grout.
4. Verify during construction :					
a. Size and location of structural elements		X		Art. 3.3F	The special inspector should verify wall thicknesses, pilaster dimensions, beam and header dimensions and the size of built-in structural elements such as boundary reinforcement.
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction		X	Sec 1.2.1(e), 6.1.4.3, 6.2.1		The masonry code references here are design provisions and do not detail the placement of inspection of anchors.
c. Welding of reinforcement	X		Sec.8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)		This is one of the few continuous inspections in Level B. Note that continuous welding inspection of reinforcing steel for concrete construction (Table 1705.2.2) is only required for shear and seismic reinforcing.
d. Preparation, construction and protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F)		X		Art. 1.8C, 1.8D	The special inspector's responsibilities include verifying whether the Contractor complies with the specification requirements related to hot and cold temperatures.
e. Application and measurement of	X			Art. 3.6B	Refer to commentary for item 2.e

CODE					COMMENTARY
TMS 402 – Table 3.1.2 TMS 602 - Table 4 Level B Quality Assurance (Table has been reformatted to accommodate commentary)					
MINIMUM TESTS					
prestressing force					
f. Placement of grout and prestressing grout for bonded tendons is in compliance	X			Art. 3.5, 3.6 C	All grouting operations are specified as continuously inspected. Proper placement of grout is critical for the structural performance of reinforced masonry. This includes consolidation and reconsolidation when grout is still in a plastic state.
g. Placement of AAC masonry units and construction of thin-bed mortar joints	X	X		Art. 3.3 B.9, 3.3.F.1.b	The footnotes to the table make it clear that continuous inspection is required for the first 5000 square feet of AAC masonry. Subsequent AAC masonry is subject to periodic inspection.
5. Observe preparation of grout specimens, mortar specimens, and/or prisms.		X		Articles 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4	The sampling and testing for masonry units, grout, or prisms is a function of the way f'_m is determined: either by the "unit strength method" or by prism testing. For the unit strength method, masonry units are sampled and tested, and grout is sampled and tested separately. The prism test method tests prisms constructed using the units, mortar, and grout for the project.

TMS 402 – Section 3.1.3 *Level C Quality Assurance* The minimum quality assurance program for masonry in Risk Category IV structures and designed in accordance with chapters other than those in Part 4 of Appendix A shall comply with Table 3.1.3.		Table 3.1.3 is the same as Table5 in TMS 602

CODE	COMMENTARY
TMS 402 – Table 3.1.3 **TMS 602 - Table 5 Level C Quality Assurance** **(Table has been reformatted to accommodate commentary)**	See comments for TMS 602 Table 4. Comments for this table will only address issues unique to this table.
MINIMUM TESTS	
Verification of f'_m and f'_{AAC} in accordance with Article 1.4.B prior to construction and for every 5,000 sq. ft (465 sq. m) during construction.	For Level C these verification activities must occur during construction.
Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout as delivered to the project site.	
Verification of slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with Article 1.5.B.1.b.3 for self-consolidating grout.	

MINIMUM INSPECTION					
Inspection Task	**Freq.**		**Reference. for Criteria**		**Commentary**
	C	P	TMS 402 ACI 530 ASCE 5	TMS 602 ACI 530.1 ASCE 6	
1. Verify compliance with the approved submittals		X		Art. 1.5	Refer to the commentary for TMS 602 Table 4 Item 1.
2. Verify the following are in compliance:					The need to verify compliance without indicating “as construction begins” makes it clear that these inspection activities must also take place during construction.
a. Proportions of site-mixed mortar, grout, and prestressing grout for bonded tendons		X		Art. 2.1, 2.6A. 2.6B, 2.6C, 2.4G.1.b	
b. Grade, type, and size of reinforcement and anchor bolts, prestressing tendons and anchorages		X	Sec. 6.1	Art, 2.4, 3.4	This inspection language focuses on the material rather than the placement addressed below.
c. Placement of masonry units and construction of mortar joints		X		Art. 3.3B	
d. Placement of reinforcement, connectors, and prestressing tendons and anchorages	X		Sec 6.1, 6.2.1, 6.2.6, 6.2.7	Art. 3.2E, 3.4, 3.6A	
e. Grout space prior to grouting	X			Art. 3.2D, 3.2F	
f. Placement of grout and prestressing grout for bonded tendons	X			Art. 3.5, 3.6 C	
g. Size and location of structural elements		X		Art. 3.3F	
h. Type, size and location of anchors, including other	X		Sec 1.2.1(e),		

MINIMUM INSPECTION					
Inspection Task	**Freq.**		**Reference. for Criteria**		**Commentary**
	C	P	TMS 402 ACI 530 ASCE 5	TMS 602 ACI 530.1 ASCE 6	
details of anchorage of masonry to structural members, frames or other construction			6.1.4.3, 6.2.1		
i. Welding of reinforcement	X		Sec. 8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)		
j. Preparation, construction and protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F)		X		Art. 1.8C, 1.8D	
k. Application and measurement of prestressing force	X			Art. 3.6B	
l. Placement of AAC masonry units and construction of thin-bed mortar joints	X			Art. 3.3 B.9, 3.3 F.1.6	
m. Properties of thin-bed mortar for AAC masonry	X			Art. 2.1 C.1	
3. Observe preparation of grout specimens, mortar specimens, and/or prisms	X			Art. 1.4 B.2.a.3, 14 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4	

CODE		COMMENTARY
TMS 402 – Section 3.1.4 Procedure The quality assurance program shall set forth the procedures for reporting and review. The quality assurance program shall also include procedures for resolution of non-compliances		The intent of the quality assurance program is achieved through the statement of special inspection, the technical specifications, and the Contract Documents for the project.
1705.5 Wood construction. Special inspections 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.		"Prefabricated" as used here, appears to refer to fabricated items as defined in Section 202 rather than manufactured wood elements such as plywood, I-joists, metal-plate connected trusses, glue-laminated beams, and other similar members that are produced in accordance with a standard that requires third party control. Because of this, special inspection of the production of these elements is not required unless it is special case where a qualifying referenced standard is not being used. The structural engineer or the building official can still require special inspection of the fabrication to be performed. CBC Section 2303.4.7 requires that wood trusses that are not made as part of a manufacturing process or

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		in accordance with a referenced standard (e.g. Truss Plate Institute's specification TPI 1) must be inspected in compliance with the fabricator inspection requirements of Section 1704.2.5.1 or the requirements of this section, as applicable. Site-built assemblies covered by this section include bracing of trusses spanning 60 feet or more and high load diaphragms. It does not include other site-built assemblies such as stud walls or floor framing systems. Thus, these items are not required to be special inspected per this section. but they may require special inspection per Sections 1705.11.1 or 1705.12.2 if they are part of the building's lateral force-resisting system.
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 construction documents. 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 construction documents.		High-load diaphragms are sheathed diaphragms with multiple rows of fastening and are most commonly used in wood diaphragms that support concrete or masonry walls for out-of-plane lateral loads. Because high-load diaphragms have multiple rows of fastening, the width of the supporting framing and the edge distance between the fastening and the edge of the framing element are more critical than typical diaphragm fastening. The shears associated with these diaphragms are typically high so it is also important to confirm that the grade and thickness of the sheathing matches with the project specifications. This requirement applies to all seismic design and wind exposure categories, whereas the inspection of other wood diaphragms is only required high wind and seismic categories. However, it is uncommon to have diaphragms in Seismic Design Categories A and B or in low wind areas that have shear demands that would require high load diaphragms.
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.		This requirement has to do with the installation of truss bracing and not the fabrication or installation of the truss members themselves. Temporary bracing is usually not addressed in the code since it is traditionally considered to be contractor means and methods and it is not critical for the performance of the completed structure. The phrase "approved truss submittal" refers to the deferred submittal approved by the building official. This does not refer to any approval of the submittal package by the design professionals during construction.
1705.6 Soils. Special inspections and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with 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.		Although the CBC requires that the inspectors use the geotechnical report to determine whether the earthwork is in compliance, the geotechnical report typically is a reference document and not a part of the contract documents. This is because the geotechnical report is not typically written to provide unambiguous instructions to the Contractor.

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During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report.		Good practice is to incorporate the recommendations of the geotechnical report into the contract documents (this is best done by the geotechnical engineer working closely with other design professionals) and then make the geotechnical report available to the contractor so that he or she is aware of the information in the report. The geotechnical engineer should be responsible for defining the details of the inspections (such as the frequency of density testing) in the contract documents and for including the inspections in the statement of special inspections. When special inspectors, not under his or her control, will be performing geotechnical inspections geotechnical engineer should provide input on the selection of the special inspectors. It is recommended that the geotechnical engineer of record be involved in performing special inspections related to his scope of work. The geotechnical engineer should be provided with copies of inspection reports related to geotechnical work when inspections are performed by other parties. Reference the Exception to Section 1804.6
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.		This modified exception is intended to be applicable for situations where recommendations for compacted fill were not required to be addressed in the geotechnical report and where there is fill less than or equal to 12 inches under shallow foundations (reference Section 1803.5.8).

Table 1705.6
Required Special Inspections and Tests of Soils
(Table has been reformatted to accommodate commentary)

Type	Continuous Special Inspection	Periodic Special Inspection	Commentary
1. Verify materials below shallow foundations are adequate to achieve the desired bearing capacity.	—	X	After footings are excavated the geotechnical engineer or special inspector need to verify that the material below the footings is compatible with the building's design criteria or the actual loads.
2. Verify excavations are extended to proper depth and have reached proper material.	—	X	The geotechnical engineer or special inspector should check the depth of the footing excavations and check that the soils exposed at the bottom of the footings correspond to what was identified in the soils report.
3. Perform classification and testing of compacted fill materials.	—	X	This is more of a verification task intended to determine the suitability of fill material (plasticity, liquid limit, gradation) and the maximum dry

Table 1705.6 Required Special Inspections and Tests of Soils (Table has been reformatted to accommodate commentary)			
Type	Continuous Special Inspection	Periodic Special Inspection	Commentary
			density (so that relative compaction can be determined).
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X	—	Section 1803.5.8 lists items related to testing and inspection criteria that the Geotechnical Report needs to provide. The construction documents need to provide the information needed by the inspectors to perform the necessary inspections.
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X	The geotechnical engineer or special inspector checks the sub-grade of a compacted fill prior to the compacted fill placement. This inspection should also be applied to footing subgrades where the project specifications include scarification and recompaction.

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1705.7 Driven deep foundations. Special inspections and tests shall be performed during installation of driven deep foundations elements as specified in Table 1705.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.		No longer do we talk about piles and piers but instead both are referred to as either “driven deep foundation elements” or “cast-in-place deep foundation elements”. A deep foundation is any driven foundation that does not satisfy the definition of a shallow foundation. Refer to the generic discussion of the Geotechnical Engineers role in special inspections in Section 1705.6 related to geotechnical issues. Engineers and geotechnical engineers should be aware of the special requirement in Section 1810.3.2.8 that installation of deep foundation elements is to be under the “direct supervision” of a registered design professional knowledgeable in the field of soil mechanics and deep foundations when higher allowable stresses are used. Section 1810.4.3 requires a location plan with a system for identifying each deep foundation element be filed with the building official prior to installation. This identification system should then be used for installation and inspection reports.

Table 1705.7 Required Special Inspections and Tests of Deep Driven Foundation Elements (Table has been reformatted to accommodate commentary)			
Type	Continuous Special Inspection	Periodic Special Inspection	Commentary
1. Verify element materials, sizes and lengths comply with the requirements.	X	—	Section 1810.4.2 requires that the grade of deep foundation materials be identified. Material verification is also implied by the references to Sections 1705.2(steel materials) and 1705.3 (concrete materials) in Items 5 and 6 of this table.
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—	This should not be construed to imply that load testing is performed by the special inspector. This testing is performed by the contractor and observed by the special inspector. The project specifications should make this clear.
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—	This inspection should be performed by the geotechnical engineer or special inspector.
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—	Note that Items 1 through 4 require continuous inspection. The special inspector needs to be on site continuously during pile installation. The special inspector should review the project plans and specifications for the locations of all piles and record all information for all piles as described in this table. The special inspector is not responsible for layout or performing an as-built survey of the piles. The required penetration should be determined by the design professional. The inspector will determine if this criterion has been satisfied.
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	—	—	The reference to Section 1705.2 implies that the material verification tasks, bolting inspection, and welding inspection for steel piles should be in accordance with the requirements of Section 1705.2 for steel elements. Refer to the commentary associated with Section 1705.2 Cutting of steel piles to length where there is no further welding involved

Table 1705.7 Required Special Inspections and Tests of Deep Driven Foundation Elements (Table has been reformatted to accommodate commentary)			
Type	Continuous Special Inspection	Periodic Special Inspection	Commentary
			should not require special inspection.
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3	—	—	See the commentary for concrete inspections in Table 1705.3 for verification and inspection tasks for reinforcing steel and concrete used in concrete piles. This includes both precast concrete piles and cast-in-place concrete piles.
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	—	—	Specialty elements as defined by Section 1810.1.4 are deep foundation elements that are not specifically mentioned in Chapter 18. Examples would be steel pipe piles that are advanced by crowd pressure (rather than driving) and/or torque and the assist of a proprietary sacrificial tip. Such piles are permitted subject to approval by the building official.

CODE		COMMENTARY
1705.8 Cast-in-place deep foundations. Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in Table 1705.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.		See the commentary in Sections 1705.6 regarding the role of the geotechnical engineer and the use of the geotechnical report. The location plan referenced in the commentary to Section 1705.7 applies to all deep foundation elements. In addition to the trigger in Section 1810.3.2.8 mentioned in the commentary to Section 1705.7, Section 1810.3.5.2.2 requires that long uncased-foundation elements be installed under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. This effectively requires that the geotechnical engineer be directly involved with this inspection activity.

Table 1705.8 Required Special Inspections and Tests of Cast-in-Place Deep Foundation Elements (Table has been reformatted to accommodate commentary)			
Type	Continuous Special Inspection	Periodic Special Inspection	Commentary
1. Inspect drilling operations and maintain complete and accurate records for each element	X	—	The geotechnical engineer or the special inspector needs to verify the soil conditions by observation of the drilling spoils. This continuous

Table 1705.8 Required Special Inspections and Tests of Cast-in-Place Deep Foundation Elements (Table has been reformatted to accommodate commentary)			
Type	Continuous Special Inspection	Periodic Special Inspection	Commentary
			inspection is particularly important where piers or drilled piles rely upon skin friction.
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end strata bearing capacity. Record concrete or grout volumes.	X	—	The requirement that the special inspector verify the locations of piers or drilled piles should not be construed to imply that the special inspector is responsible for layout or performing an as-built survey of the piers. Specifications should clearly make those tasks the contractor's responsibility. For piers or drilled piles utilizing end bearing, the specifications should be clear regarding cleaning of the bottom and the method to be used to verify the cleanliness and the soil strata.
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3	—	—	See the commentary for concrete inspections in Table 1705.3 for verification and inspection tasks for reinforcing steel and concrete used in concrete piles.

CODE		COMMENTARY
1705.9 Helical pile foundations. Continuous special inspections shall be performed during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.		Refer to the generic discussion of the "…Geotechnical Engineer's role…" in special inspections in Section 1705.6 related to geotechnical issues. The location plan referenced in the commentary to Section 1705.7 applies to all deep foundation elements. The requirement in Section 1810.3.2.8 which can require "direct supervision" of pile installation applies to helical piles. See the commentary to Section 1705.7.
1705.10 Fabricated items. Special inspections of fabricated items shall be performed in accordance with Section 1704.2.5.		Section 1704.2.5 contains special provisions that apply when items that are otherwise subject to special inspection are fabricated in the fabricators shop. Thus, this item is not be listed in the model statement of special inspection included in these guidelines.
1705.11 Special inspection for wind resistance. Special inspections itemized in Sections 1705.11.1 through 1705.11.3, unless exempted by the exceptions in Section 1704.2, are required for buildings and structures constructed in the following areas.		See the discussion in Chapter 5 under "Special Requirements for Wind Resistance". In California there are no regions where Condition 1 occurs. Condition 2 only occurs in small areas in Southern California.

CODE		COMMENTARY
1. In wind Exposure Category B where V_{asd} as determined in accordance with Section 1609.3.1 is 120 miles per hour (52.8 m/sec) or greater. 2. In wind Exposure Category C or D, where V_{asd} as determined in accordance with Section 1609.3.1 is 110 miles per hour (49 m/sec) or greater.		Sections 1705.11.1 and 1705.11.2 contain the only requirements for additional special inspections associated with the main windforce-resisting system. Only wood framing and cold-formed light-frame construction are included. Thus, buildings using structural steel, concrete, or masonry to resist wind loads do not require any additional special inspections due to wind, other than what is required for roof and wall cladding by Section 1705.11.3. The 2010 CBC, Section 1705.4.2 included a list of systems and components that should be included in the inspections. The list while no longer in the code is reproduced, for information only: *1. Roof cladding and roof framing connections.* *2. Wall connections to roof and floor diaphragms and framing.* *3. Roof and floor diaphragm systems, including collectors, drag struts and boundary elements.* *4. Vertical wind force-resisting systems, including braced frames, moment frames and shear walls.* *5. Wind force-resisting system connections to the foundation.* *6. Fabrication and installation of systems or components required to meet the impact-resistance requirements of Section 1609.1.2.* ***Exception:** Fabrication of manufactured systems or components that have a label indicating compliance with the wind-load and impact-resistance requirements of this code.*
1705.11.1 Structural wood. Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs. **Exception:** Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the main windforce-resisting system, where the fastener spacing of the sheathing is more than 4 inches (102 mm) on center.		These requirements are very similar to those for high-seismic areas. See the commentary for Section 1705.12.2 for further discussion on these inspections.
1705.11.2 Cold-formed steel light-frame construction. Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of		Provisions for cold-formed steel light-frame construction are very similar to wood framing. Refer to the commentary to Section 1705.12.3.

CODE		COMMENTARY
elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs. **Exception:** Special inspections are not required for cold-formed steel light-frame shear walls, and diaphragms, including screwing, bolting, anchoring and other fastening to components of the windforce resisting system where either of the following applies: 1. The sheathing is gypsum board or fiberboard. 2. The Sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the fastener spacing of the sheathing is more than 4 inches (102 mm) on center (o.c.).		
1705.11.3 Wind-resisting components. Periodic special inspection is required for fastening of the following systems and components: 1. Roof covering, roof deck and roof framing connections. 2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.		Cladding can include structural elements that resist wind loads but more commonly it includes components that are applied over the structural elements. The Design Professional of Record responsible for designing the cladding will need to take the lead in identifying those products and systems that are impacted by wind loads. The technical specifications sections will need to identify the aspects of the roof or wall cladding installation that will be subject to special inspection. The statement of special inspections needs to be coordinated with the technical specifications.
1705.12 Special inspections for seismic resistance. Special inspections for seismic resistance shall be required as specified in Sections 1705.12.1 through 1705.12.9 unless exempted by the exceptions of Section 1704.2.		

CODE		COMMENTARY
Exception: The special inspections specified in Sections 1705.12.1 through 1705.12.9 are not required for structures designed and constructed in accordance with one of the following: 1. The structure consists of light-frame construction; the design spectral response acceleration at short periods, S_{DS}, as determined in Section 1613.3.4, does not exceed 0.5; and the building height of the structure does not exceed 35 feet (10 668 mm). 2. The seismic force-resisting system of the structure consists of reinforced masonry or reinforced concrete; the design spectral response acceleration at short periods, S_{DS}, as determined in Section 1613.3.4, does not exceed 0.5; and the building height of the structure does not exceed 25 feet (7620 mm). 3. The structure is a detached one- or two-family dwelling not exceeding two *stories above grade plane* and does not have any of the following horizontal or vertical irregularities in accordance with Section 12.3 of ASCE 7: 3.1. Torsional or extreme torsional irregularity. 3.2. Nonparallel systems irregularity. 3.3. Stiffness-soft story or stiffness-extreme soft story irregularity. 3.4. Discontinuity in lateral strength-weak story irregularity.		Exceptions 1 and 2 apply to qualifying buildings of all occupancies whereas Exception 3 applies only to residences. Exceptions 1 and 2 do not apply to structural steel buildings regardless of the design seismic acceleration or height. Residential occupancies with no more than two stories are exempt per Exception 3 if they are regular structures. However, a fair amount of these occupancies have an irregular features including open storefronts, split level floors and roofs, shear-resisting walls at odd angles, and other features that may cause the structure to fall into one of the irregularities listed. Refer to the discussion in the introduction regarding buildings constructed in accordance with the California Residential Code.
1705.12.1 Structural steel. Special inspection for structural steel shall be in accordance with the Section 1705.12.1.1 or 1705.12.1.2, as applicable. **1705.12.1.1** *Special inspections* ~~for structural steel~~ of structural steel seismic-force resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341. **Exception:** *Special inspections* ~~of structural steel~~ are not required in the seismic-force resisting systems of buildings and structures assigned to *Seismic Design Category* B or C that are not specifically detailed for seismic resistance, with a response modification coefficient, *R*, of 3 or less, excluding cantilever column systems.		Chapter J of AISC 341 provides the special inspection requirements for structural steel. Refer to the commentary of Section 1705.2, Refer to the discussion related to Section 1705.2.1 related to continuous, periodic, observe, and perform. A key difference from the provisions for AISC 360 is that the "Observe" level of inspection, defined as occurring "on a random, daily basis". Because AISC 341 does not require in-process inspection more frequent than once a day it may be appropriate for the engineer to require more frequent inspections for crucial welds (such as demand critical welds). The exception applies to steel seismic systems that are expected to have little ductility demand. AISC 341 Section J5.3 defines the term "Document" Which AISC 341 uses in addition to Observe and Perform Selected provisions from AISC 341 have been included in these guidelines.

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1705.12.1.2 Structural Steel elements. *Special inspections* of *structural steel elements* in seismic-force resisting systems of buildings and structures assigned to *Seismic Design Category* B, C, D, E or F other than those covered in Section 1705.12.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341. **Exception:** *Special inspections* of *structural steel elements* are not required in the seismic-force resisting systems of buildings and structures assigned to *Seismic Design Category* B or C with a response modification coefficient, *R*, less than 3.		The concept of a structural steel element was introduced into the code to encompass those steel elements that are not considered "structural steel" as defined in the AISC COSP. This section makes it clear that structural steel elements that are part of the lateral system are subject to the same special inspection requirements as "structural steel members" Most of the inspection requirements in AISC 341 are duplicate of those required by AISC 360 and thus do not need to be duplicated. With this in mind the model schedule of special inspection in the appendicles only addresses the unique requirements in AISC 341.
AISC 341 J5.4 Coordinated Inspection Where a task is noted to be performed by both QC and QA, coordination of the inspection function between QC and QA is permitted in accordance with Specification Section N5.3.		See comment related to AISC 360 N5.3
AISC 341 J6.1 Visual Welding Inspection (partial) "All requirements of the Specification shall apply, except as specifically modified by AWS D1.8/D1.8M."		The criteria in AWS D1.8 is more restrictive than that in AWS D1.1
AISC 341 J6.2 NDT of Welded Joints. (partial) In addition to the requirements of *Specification* Section N4.5, nondestructive testing of welded joints shall be as required in this section:		Section 1705.13.1.1 has a duplicate requirement for NDT testing of welded joints. ICC and AISC should coordinate this. The model statement of special inspection provided in these guidelines will address this requirement in Section 1705.13.1.1 and not in this section to prevent duplication. Refer to comments regarding AISC 360 N5.5. The reference to Section N4.5 doesn't exist and it is believed that Section N5.5 is the intended reference. AISC 341 J6.2e requires the engineer of record's approval for reducing the percentage of magnetic particle testing for CJP welds but does not require permission for other uses of magnetic particle testing.
AISC 341 J7 Inspection of High-Strength Bolting Bolting inspection shall satisfy the requirements of Specification Section N5.6 and this section. Bolting inspection shall be performed by both quality control and quality assurance personnel. As a minimum, the tasks shall be as listed in Tables J7-1, J7-2 and J7-3.		The tasks are already covered by AISC 360
AISC 341 J8 Other Steel Structure Inspections Other inspections of the steel structure shall satisfy the		This section includes inspections of reduced beam sections and protected zones to assure it has not been compromised by

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requirements of Specification Se3ction N5.7 and this section. Such inspections shall be performed by both quality control and quality assurance personnel. Where applicable, the inspection tasks listed in Table J8-1 shall be performed.		other construction. Consideration should be given to repeating this inspection after other trades have completed their work since problems have been reported with various trades attaching to the protected zone in an unacceptable manner.
AISC 341 J9 Inspection of Composite Structures (partial) "Where applicable, inspections of the composite structures shall satisfy the requirements of Specification Section N6 and this section."		It is suggested that the provisions related to quality assurance of cast in place concrete are superseded by the provisions of Section 1705.3. Thus, Section J9 is not relevant since those requirements are already addressed in the body of the CBC which takes precedence over provisions in the referenced standards.
AISC 341 J10 Inspection of H Piles Where applicable, inspection of piling shall satisfy the requirements of this section. These inspections shall be performed by both the responsible contractor's quality control personnel and by quality assurance personnel. Where applicable, the inspection tasks listed in Table J10-1 shall be performed.		Contrary to the AISC 341 commentary for this section changes to the IBC/CBC require that steel piles are subject to the same inspection requirements as structural steel elements.
1705. 12.2 Structural wood. For the seismic force-resisting sysstems of structures assigned to Seismic Design Category C, D, E or F: 1. Continuous special inspection shall be required during field gluing operations of elements of the seismic-force-resisting system. **2.** Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic-force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.		The primary focus of these inspections should be on the connections of the lateral resisting elements, including the diaphragm and shear wall nailing, the nailed straps and bolted connections at the drag struts and chord members, top plate splices, nails and clips connecting the diaphragms to the walls, holdown attachments, and wall anchor bolts. This provision also applies to wood framing that is part of the lateral force resisting system that also includes other elements, such as wood roofs in tilt-up concrete and masonry walled buildings. Wall anchors, diaphragm nailing, and tie straps associated with this type of construction also require periodic inspection. The special inspection of field gluing operations appears to be applicable to only a limited number of conditions. Section 4.3.6.3.1 of the American Forest and Paper Association's *Special Design Provisions for Wind and Seismic* (SDPWS) specifically limits the use of adhesives in shear walls to Seismic Design Categories A, B, and C, of which only SDC C would apply to this section. SDPWS Section 4.2.6.3 permits the use of adhesives in horizontal diaphragms in combination with nails or other approved fasteners. However, these adhesives are not considered to be part of the lateral force resisting system and are assumed to not contribute to the lateral force strength of the diaphragm. Thus field gluing of horizontal diaphragms for non-structural applications such as to mitigate floor squeaking would not require special inspection.

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Exception: Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the seismic-force-resisting system, where the fastener spacing of the sheathing is more than 4 inches (102 mm) on center.		This exception is intended to exempt less highly-stressed lateral force resisting systems from special inspection. The exception eliminates special inspections for each shear wall or diaphragm that has fastening spacing greater than 4 inches on center and their connections to other components of the main lateral force resisting system, including hold-downs that are within an exempt shear wall and collectors that are part of an exempt horizontal diaphragm. Often, however, the structural design will include walls or diaphragms with nail spacing both less than and greater than 4 inches. In addition, engineers have learned from field experience that nails installed with nailing guns are often overdriven or misplaced, and other structural connections not normally part of standard framing practices are sometimes missed completely. Engineers should use judgment and caution in invoking this exception. The construction documents should clearly distinguish which lateral force resisting elements require special inspection and which are exempt.
1705.12.3 Cold-formed steel light-frame construction. For the seismic-force-resisting systems of structures assigned to Seismic Design Category C. D. E or F. . Periodic special inspection shall be required. 1. For welding operations of elements of the seismic force resisting system; and 2. For screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs. **Exceptions:** Special inspections are not required for cold-formed steel light-frame shear walls and, diaphragms including screw installation, bolting, anchoring and other fastening to components of the seismic force-resisting system, where either of the following applies: 1. The sheathing is gypsum board or fiberboard. 2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the fastener spacing of the sheathing is more than 4 inches (102 mm) on center.		Other than the inspections required for cold-formed steel trusses, cold-formed steel light-frame construction does not require special inspection except under the special wind and seismic requirements. The inspections are similar to those required for wood seismic force resisting elements and are identical to those required in high wind regions. The exemption based on fastening spacing greater than 4 inches was added to match the exception granted to wood. The effect of Exception #1 is that partitions and lightly loaded walls are excluded from special inspection. Even when the light frame construction is exempted by the exceptions the engineer should consider requiring this special inspection because of the critical role of the lateral system.
1705.12.4 Designated seismic system. For structures assigned to Seismic Design Category C, D, E or F the special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section		This requirement applies to non-structural systems that are classified as designated seismic systems in accordance with Section 1705.13.3. Refer to the definition of “designated seismic system” in Chapter 2 of the CBC.

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13.2.2 of ASCE 7 and verify that the label, anchorage and mounting conform to the certificate of compliance.		The special inspector is only required to verify that the equipment installed is the same equipment for which the submitted certification applies and that the anchorage and mounting is as required by the construction documents.
1705.12.5 Architectural components. Periodic special inspection is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F. **Exception:** Periodic special inspection is not required for the following. 1. Exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer 30 feet (9144 mm) or less in height above grade or walking surface. 2 Exterior cladding and interior and exterior veneer weighing 5 psf (24.5 N/m2) or less. 3. Interior nonbearing walls weighing 15 psf (73.5 N/m2) or less.		This section is intended to cover all non-bearing exterior walls, heavier interior non-bearing wall elements, and heavier veneers. This inspection is intended to be periodic and to focus on the connections of these elements to their supports. Special inspection of architectural components is not required if they are less than 30 feet above grade or walking surface. This reference to walking surface implies that the concern is how high the component can fall before hitting individuals. Thus, interior veneer or non-bearing walls located below grade could conceivably be subject to special inspection. Inspection of interior and exterior nonbearing walls and veneer is required unless the exceptions apply. Previously special inspection of suspended ceilings was required but this requirement has been deleted. If special inspection is desired for ceiling systems, the design professional must make that clear in the statement of special inspections and on the construction documents. The inspection of suspended ceilings should include verification of member type and size, verification that bracing elements, such as splay wires and compression struts, are installed as detailed, and the appropriate inspection and testing of the installation of anchorages to the structure. When the component is qualified by certification (ASCE 7 Section 13.2.1) there are no provisions requiring verification that the certification is consistent with what was installed. The design professional should consider requiring verification inspections. When verification inspections are provided the special inspector is only required to verify that the component installed is the same component for which the submittal certification applies and that the anchorage is in accordance with the certification.
1705.12.5.1 Access floors. Periodic *special inspection* is required for the anchorage of access floors in structures assigned to *Seismic Design Category* D, E or F.		Access floors are most often used in computer facilities, offices, and manufacturing plants. Post-installed anchors are often used to anchor these elements, and it could be argued that inspection for post installed anchors is already required by Table 1705.3 item 4. While the wording of this section suggests that only the anchorage requires special inspection, consideration should be given to the inspection of the assemblies. This as a minimum would include periodically inspecting the connections of the access floor components for tightness and completeness. The type of anchorage to be used to anchor the access floor

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		system should be explicitly specified. If this is not clear the inspector should ask for clarification from the design professional.
1705.12.6 Plumbing, mechanical and electrical components. Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following: 1. Anchorage of electrical equipment for emergency or standby power systems in structures assigned to Seismic Design Category C, D, E or F. 2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category E or F. 3. Installation and anchorage of piping systems intended to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F. 4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category C, D, E or F; and 5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the approved construction documents require a nominal clearance of 1/4 inches (6.4 mm) or less between the equipment support frame and restraint.		Change in nomenclature used to identify components, refers to hazardous materials. The change also adds anchorage of ductwork and piping. Many of the items of equipment covered by these provisions are anchored to concrete using either cast-in-place or post-installed anchors that already require special inspection per other sections of the code. The special inspector should visually inspect the welds and anchors used to connect these elements to their supports for soundness and compliance with the contract documents. Since these inspection requirements are based on the equipment's use, the mechanical and electrical engineers should specify which systems are subject to these inspections. The structural engineer should notify the mechanical and electrical engineer of the Seismic Design Category so that they can correctly specify the inspections required. When the component is qualified by certification (ASCE 7 Section 13.2.1) there are no provisions requiring verification that the certification is consistent with what was installed. The design professional should consider requiring verification inspections. When verification inspections are provided the special inspector is only required to verify that the equipment installed is the same equipment for which the submittal certification applies and that the anchorage is in accordance with the certification.
1705.12.7 Storage racks. Periodic special inspection is required during the anchorage of storage racks that are 8 feet (2438 mm) or greater in height in structures assigned to Seismic Design Category D, E or F.		Inspection of storage rack anchorage is now required for all tall storage racks in SDC D, E, or F. Special inspection of post-installed anchors are already required by Table 1705.3 item 4. If cast-in-place anchors are used they should be inspected per Table 1705.3 Item 3. While this section only requires special inspection of the installation of the anchorage consideration should be given to the installation of the storage rack assemblies. When this is done the connections of the rack components should be periodically inspected for tightness and completeness. So the focus is on the assembly and installation of the components and not on the elements and assemblies fabricated in the manufacturing plant.
1705.12.8 Seismic isolation system. Periodic special inspection shall be provided for seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F during the fabrication and		While this section is titled seismic isolation systems it is clear from the text that it also applies to dampers that are a part of the seismic isolation system. It would thus appear that damping devices that are not part of an isolation system would

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installation of isolator units and energy dissipation devices.		not require special inspection. The inspection requirements are outlined in Chapter 17 of ASCE-7.The special inspector will verify that the isolation units tested correspond to the isolation units provided based on the qualification test report referenced in the commentary for Section 1705.13.4.
1705.12.9 Cold-formed steel special bolted moment frames. Periodic special inspection shall be provided for the installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F,		
1705.13 Testing for seismic resistance. Testing for seismic resistance shall be required as specified in Sections 1705.13.1 through 1705.13.4, unless exempted from special inspections by the exceptions of Section 1704.2.		This section was introduced to differentiate testing requirements from inspection requirements. This makes some sense when the testing was done in a laboratory but appears to be an artificial differentiation when talking about NDT testing that is an integral part of the reference standard that has been previously been referenced.
1705.13.1 Structural steel. Nondestructive testing for seismic resistance shall be in accordance with Sections 1705.13.1.1 or 1705.13.1.2, as applicable.		NDT for seismic is treated different than how it is treated for other welds. The NDT requirements in AISC 360 are specified in Section 1705.2.1along with the weld inspections. While AISC 341also addresses NDT requirements the code specifies these requirements here and not in Section 1705.12.1. Thus the model statement of special inspection in the appendix includes a line item for 1705.13.1. See commentary under Section 1705.12.1 Sections 1705.13.1.1 and 1704.13.1.2 are necessary to deal with steel elements that are considered structural steel as well as those considered to be “structural steel elements”.
1705.13.1.1 Seismic force-resisting systems. Nondestructive testing of structural steel seismic-force resisting systems in buildings and structures assigned to *Seismic Design Category* B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341. **Exception:** Nondestructive testing of structural steel is not required in the seismic-force resisting systems of buildings and structures assigned to *Seismic Design Category* B or C that are not specifically detailed for seismic resistance, with a response modification coefficient, *R*, of 3 or less, excluding cantilever column systems.		The exceptions have been added to exempt inspection requirements for welds that are not expected to experience significant inelastic demand.
1705.13.1.2 Structural steel elements. Nondestructive testing of *structural steel elements* in seismic-force resisting systems of buildings and structures assigned to *Seismic Design Category* B, C, D, E or F other than those		

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covered in Section 1705.13.1.1, including struts, collectors, chords and foundation elements shall be performed in accordance with the quality assurance requirements of AISC 341. **Exception:** Nondestructive testing of *structural steel elements* is not required in the seismic-force resisting systems of buildings and structures assigned to *Seismic Design Category* B or C with a response modification coefficient, *R*, of 3 or less.		
1705.13.2 Nonstructural components. For structures assigned to Seismic Design Category B, C, D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by seismic qualification as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic qualification by analysis, testing or experience data. Certificates of compliance for the seismic qualification shall be submitted to the building official as specified in Section 1704.5		This requirement applies to components that are not subject to special certification requirements but are nevertheless qualified for use by submittal of seismic certification by the manufacturer. ASCE-7 Section 13.2.1 permits seismic qualification of components by manufacturer's certification in lieu of a project specific design by registered design professionals. The registered design professional who specified the component is charged with specifying the criteria the manufacturer must satisfy. This section then reiterates the requirement that the certifications submitted by the contractor be submitted to the building official as required by Section 1704.5. It is not clear what this section accomplishes since the design professional always needs to specify the criteria the contractor must satisfy, and the submittal requirement is already specified elsewhere. Further because the testing is to be performed by the manufacturer it seems inappropriate to include this in a code section supposedly focused on QA testing by the Owner and its consultants. While the registered design professional responsible for the design of the component, is responsible for specifying the requirements, the structural engineer will likely need to provide technical design criteria such as accelerations, and relative displacements of supports. If experience data is submitted it must be from equipment that is of comparable type, model, and structural integrity to the equipment that is being certified. While the analysis or testing will need to be done under the supervision of a registered design professional it is not required that this be done by the design professionals or the special inspector for the project. When manufacturers submit generic test results using "maximum" potential seismic forces and "standard" equipment assemblies the design professionals and the building official will need to determine the applicability of the tests to their specific project Item 1 of Section 13.2.1 of ASCE 7, which deals with project specific approval of components, requires that the

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		construction documents be reviewed by a registered design professional and approved by the AHJ, but when Item 2 is used and the manufacturer certifies the equipment, the approval by the AHJ or the review by the registered design professional is not required.
1705.13.3 Designated seismic systems. For structures assigned to Seismic Design Category C, D, E, or F and with designated seismic systems that are subject to the requirements of Section 13.2.2 of ASCE 7 for certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis, testing or experience data as specified therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704.5		Section 1705.4 already requires verification that the certifications provided correspond to the components installed and that the attachments are consistent with the certification. This applies to designated seismic systems defined in Section 202. These components are equipment that must either be operable after an earthquake or that contain hazardous substances. The design professionals that specified these components need to determine whether they should be classified as designated seismic systems and specify the design criteria. The structural engineer will likely need to provide technical design criteria such as accelerations, and relative displacements of supports. The registered design professional who specified the component is charged with specifying the criteria the manufacturer must satisfy. This section then reiterates the requirement that the certifications submitted by the contractor be submitted to the building official as required by Section 1704.5. It is not clear what this section accomplishes since the design professional always needs to specify the criteria the contractor must satisfy and the submittal requirement is already specified elsewhere. Further because the testing is to be performed by the manufacturer it seems inappropriate to include this in a code section supposedly focused on QA testing by the Owner and its consultants.
1705.13.4 Seismic isolation systems. Seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B. C, D, E or F shall be tested in accordance with Section 17.8 of ASCE 7.		This provision applies specifically to isolation systems used to isolate structures. Vibration isolation systems for mechanical, electrical, and plumbing equipment are covered under Section 1705.12.6 It is expected that the RDP will review the test report for compliance with construction documents.
1705.14 Sprayed fire-resistant materials. Special inspections and tests of sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections		This section gives detailed requirements for inspection of sprayed fire-resistant materials. This section is intended to align with ASTM E 605, the standard for sampling and testing of the thickness and density

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1705.14.1 through 1705.14.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections and tests shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, where applicable.		of fire-resistant material. CBC Chapter 7 gives the requirements for fire-resistance-rated construction. The design documents should include material specifications, substrate preparation, and thickness requirements. Special inspections of SFRM is performed prior, during and after installation of the product. The inspection of substrates needs to be done prior to installation of the fire-proofing. Inspection during installation to verify compliance to specified requirements. Some inspections may also need to be done after installation of other systems since the installation of the other systems may preclude inspection of the fire-resistant materials or may damage the installed product.
1705.14.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire resistance rating. 1. Condition of substrates. 2. Thickness of application. 3. Density in pounds per cubic foot (kg/m^2) 4. Bond strength adhesion/cohesion. 5. Condition of finished application.		The details of these inspections and tests are addressed in the next sections.
1705.14.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the special inspector before the application of the sprayed fire-resistant material.		This first sentence states a design requirement that should be on the contract documents. Inspection includes verification of the substrate condition. This section and the next section make reference to “approved manufacturers”. This is not consistent with the building code’s definition wherein “approved” means “by the building official”. In this context, the assumed intent is that the inspector should make use of the submittals reviewed and accepted by the design professional.
1705.14.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.		This entire section deals with design and workmanship requirements that should be part of the contract documents. Although not specifically stated, it is implied that the special inspector’s work includes verifying ambient temperature and adequate ventilation.
1705.14.4 Thickness. No more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705.14.4.1.		These two sections give acceptance criteria and a tolerance for the thickness measurement inspection which may differ slightly from that in ASTM E 605. ASTM E 605 describes how to determine fireproofing thickness by inserting a depth gauge into the material at required frequencies.

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1705.14.4.1 Minimum allowable thicknesses. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus ¼ inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E 605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705.14.4.2 and 1705.14.4.3.		
1705.14.4.2 Floor, roof and wall assemblies. The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E 605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.		ASTM E 605 specifies the frequency of thickness testing but states that the applicable building code governs the number of thickness testing measurements.
1705.14.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. A minimum of four measurements shall be made, located symmetrically within the square area.		These two sections detail the sampling for different types of deck.
1705.14.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. A minimum of four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.		
1705.14.4.5 Structural members. The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E 605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.		This section gives the frequency of thickness testing measurements for framing members: 25 percent of members on each floor.
1705.14.4.6 Beams and girders. At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.		These four sections detail the sampling for different structural framing members.
1705.14.4.7 Joists and trusses. At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.		
1705.14.4.8 Wide-flanged columns. At wide –flanged columns, thickness measurements shall be made at 12 locations around the wide-flanged column at each end of a 12-inch (305 mm) length.		

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1705.14.4.9 Hollow structural section and pipe columns. At hollow structural section and pipe columns, thickness measurements shall be made at a minimum of four locations around the column at each end of a 12-inch (305 mm) length.		
1705.14.5 Density. The density of the sprayed fire-resistant material shall not be less than the density specified in the approved fire-resistant design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E 605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows: 1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) or portion thereof of the sprayed area in each story. 2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof of in each story.		Density tests are performed in the laboratory on fire-resistant material sampled in the field by scraping from designated areas using a template over applied material. For Item 1 the tests are performed for each 2,500 square feet sprayed area for each story while for Item 2 the tests are performed for each 2,500 square feet of floor area for each story.
1705.14.6 Bond strength. The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall not be less than 150 pounds per square foot (psf) (7.18 kN/m2). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E 736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705.14.6.1 through 1705.14.6.3.		In-place bond tests are performed by adhering a metal or plastic bottle cap with attached hook to a section of fire-resistant material and applying a manual load – measured on a scale – until failure occurs. Do not score SFRM around the cap. ASTM E 736 is only a sampling and testing method. This code section includes the acceptance criteria, and the testing frequency is given in the sections below. High rise buildings (greater than 75 feet in height) require higher bond strength as noted in Section 403.2.4. It appears that the required bond strength, determined by Section 403.2.4 would apply to all floors in the building.
1705.14.6.1 Floor, roof and wall assemblies. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m2) of the sprayed area, or portion thereof, in each story. **1705.14.6.2 Structural members.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, columns and other structural members at the rate of not less than one sample for each type of structural framing member for each 2,500 square feet (232		An important difference between the tests specified in Sections 1705.14.6.1 and 1705.14.6.2 is that for Section 1705.14.6.1 the tests are performed for each 2,500 square feet sprayed area for each story while for Section 1705.14.6.2 the tests are performed for each 2,500 square feet of floor area for each story. This section applies only where the compatibility of the fireproofing with a painting system "has not been determined". These bond tests are pre-construction tests to determine whether an additional bonding agent may be required. The bond testing of the production work would still be required as described above.

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m2) of floor area or portion thereof in each story. **1705.14.6.3 Primer, paint and encapsulant bond tests.** Bond tests to qualify a primer, paint or encapsulant shall be conducted when the spray fire-resistant-material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.		
1705.15 Mastic and intumescent fire-resistant coatings. Special inspections and tests for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be performed in accordance with AWCI 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents.		According to AWCI (American Wall and Ceiling Industry) *Technical Manual 12-B* the special inspection shall include the following tests and observations to demonstrate compliance with the listing and the fire-resistance rating: 1. Condition of substrate 2. Thickness of application 3. Condition of finished application 4. Condition of patching
1705.16 Exterior insulation and finish systems (EIFS). Special inspections shall be required for all EIFS applications. **Exceptions:** 1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior. 2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls. **1705.16.1 Water-resistive barrier coating.** A water-resistive barrier coating complying with ASTM E 2570 requires special inspection of the water-resistive barrier coating when installed over a sheathing substrate		EIFS generally consists of polystyrene or other foam board coated with a thin synthetic coating. The foam board provides insulation and the coating provides waterproofing. The system is typically attached to the substrate by adhesives, screws or both. Section 1705.16 requires special inspection of the water-resistive barrier coating below an EIFS system. The CBC does not specifically detail the EIFS inspections or the inspection of the water-resistive barrier. These exceptions imply that the focus of the inspection is on the waterproofing function and not on the attachment. Language detailing the inspection should be included in the architectural drawings or specifications, and the architect should make sure that the requirements are referenced in the statement of special inspections.
1705.17 Fire-resistant penetrations and joints. In high-rise buildings or in buildings assigned to *Risk Category* III or IV special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire barrier systems that are tested and listed in accordance with Sections 714.3.1.2, 714.4.2, 715.3 and 715.4 shall be in accordance with Section 1705.17.1 or 1705.17.2.		The inspection of perimeter fire barrier systems are addressed in ASTM E2393 which is referenced in Section 1705.17.2
1705.17.1 Penetration firestops. Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.3.1.2 and 714.4.2 shall be conducted by an approved inspection agency in accordance with ASTM E 2174.		ASTM E2174:- Standard Practice for On-Site Inspection of Installed Firestops.

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1705.17.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3 and 715.4 shall be conducted by an approved inspection agency in accordance with ASTM E 2393.		ASTM E2393: - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
[F] 1705.18 Testing for smoke control. Smoke control systems shall be tested by a special inspector.		This section needs to be carefully coordinated with Sections 909.3 and 909.18.8. There is some duplication but some differences. In a departure from other special inspections this section requires that a copy of the final report be filed with the fire code official and that a copy be maintained in the building. Special inspection of smoke control systems as described in CBC Section 909.3 shall consist of special inspections and tests sufficient to verify the proper commissioning of the smoke control system. The items subjected to these inspections and the detailed procedures and methods to be performed shall be clearly noted on the construction documents. Section 909.18.8 provides additional information regarding special inspection of smoke control systems. Section 909.18.8.3 requires RDP sign and seal a report prepared by others. This may be in violation of licensing laws and will have liability implications. It appears that the provisions of IBC Section 909 are in many ways the same as the provisions of IFC Section 909.
[F] 1705.18.1 Testing scope. The test scope shall be as follows: 1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location. 2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.		This scope is essentially a duplicate of CBC Section 909.18.8.1. The items subjected to these tests and the detailed procedures and methods to be performed shall be clearly noted on the construction documents.
[F] 1705.18.2 Qualifications. Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.		Qualifications of smoke control special inspectors can be difficult to assess. Established special inspection agencies have typically specialized in structural inspections, and agencies offering smoke control system special inspection do not employ personnel carrying the same type of certifications. Special inspection of smoke control systems are typically performed by a licensed fire protection engineer or mechanical engineer with verifiable expertise and experience. Air balancers are typically certified by the Associated Air Balance Council or National Environmental Balancing Bureau.

SECTION 1706 **DESIGN STRENGTHS OF MATERIALS**		These sections are not related to inspection and testing for a construction project.
SECTION 1707 **ALTERNATIVE TEST PROCEDURE**		
SECTION 1708 **IN-SITU LOAD TESTS**		
SECTION 1709 **PRECONSTRUCTION LOAD TESTS**		

END OF CODE/COMMENTARY FORMAT

Chapter 2 Structural Observation

The CBC sections containing the requirements for structural observation are shown in italics below:

Section 202. DEFINITIONS

STRUCTURAL OBSERVATION *The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents.*

1704.6 Structural observations. *Where required by the provisions of Section 1704.6.1 or 1704.6.2 the owner or the owner's authorized agent shall employ a registered design professional to perform structural observations. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705 or other sections of this code.*

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.

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.

1704.6.1 Structural observations for seismic resistance. *Structural observations shall be provided for those structures included in Seismic Design Category D, E or F, where one or more of the following conditions exist:*

1. *The structure is classified as Risk Category III or IV .*
2. *The height of the structure is greater than 75 feet (22 860 mm) above the base as defined in ASCE 7.*
3. *The structure is assigned to Seismic Design Category E, is classified as Risk Category I or II, and is greater than two stories above grade plane.*
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/s), where one or more of the following conditions exist:*

1. *The structure is classified as Risk Category III or IV.*
2. *The building height 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.*

2.1 Overview

The CBC specifically differentiates between structural observation and special inspections. Structural observation focuses on the building's structural system, rather than on the use of particular materials or processes. Structural observation is non-continuous and uses visual means only to determine if the construction is in general conformance with the intent of the plans and specifications. In contrast, special inspections are comprehensive, systematic, and detailed with a focus on materials, workmanship, and processes.

Structural observation is an important component of the quality assurance process that the Owner implements in conjunction with his consultants.

Structural observation allows the engineer to determine if the contractor is interpreting the structural aspect of the construction documents correctly. The engineer's site presence and regular communication with the contractor improves the likelihood nonconforming conditions will be identified early in the construction phase when they are cheaper and less disruptive to resolve.

For additional discussion of structural observation, refer to the SEAOC "Recommended Guidelines for the Practice of Structural Engineering in California" Fifth Edition available through the SEAOC office.

2.2 Conditions Requiring Structural Observation

The conditions triggering structural observation (Section 1704.5) are based on the structure's Risk Category, height and Seismic Design Category. While these triggers are tied to the wind and seismic force resisting systems, structural observation is often considered to apply to all elements of the structural system.

CBC Sections 1704.6.1 and 1704.6.2 allow the registered design professional responsible for the structural design to require structural observation even when not required by the other triggers in the code. Engineers should advise their clients about the benefits of including structural observations in the engineer's scope of services especially when there are critical or complex elements in the structural system.

The CBC requires structural observation for Risk Categories III and IV or structures over 75 feet in height in Seismic Design Category D and above. Additionally, all structures three or more stories in height in Seismic Design Category E require structural observation.

The requirements related to wind are only applicable where the basic wind speed exceeds 110 mph, which occurs only in very limited areas of California.

Although the code allows any "registered design professional" to be the structural observer, it is recommended that the engineer of record or another engineer familiar with the structure perform the site visits.

2.3 Timing of Site Visits

Since the 2010 CBC, site visits are no longer tied to "significant construction stages". Determination of when to make site visits is left to the registered design professional's discretion. Generally, the number of site visits is a function of the building size and complexity, the client's sensitivity to quality assurance, and the contractor's performance.

Engineering judgment dictates the timing of structural observation site visits. At times, structural observations can take place at regular intervals, while at other times it may be appropriate for site visits to be coordinated with specific stages of the work. To plan the site visits, it is important that the engineer be kept informed of the progress of the work.

The requirement for a "written statement identifying the frequency and extent of structural observations" will require that the engineer develop at least an outline of the planned site visits. The statement should not be considered a specific schedule of structural observation activities. Instead it is a general description of when structural observation visits are intended to occur, and a general description of the items slated for review. Thus "frequency" should not be interpreted to mean the code intends for structural observations to occur on a regularly recurring, periodic, time interval.

This statement is not submitted for permit approval but is required prior to the start of construction.

Some building officials require site visits by the engineer of record to inspect or observe the work prior to the building department's inspections. There is no CBC requirement for such site visits. The Engineer should determine if the building official is asking for observation or an inspection and be aware of potential impacts on their scope of services and liability exposure.

2.4 Structural Observations

The SEAOC "Recommended Guidelines for the Practice of Structural Engineering in California" states:

> "Structural observation affords the ER the opportunity to observe and become generally familiar with the quality and progress of the construction. Structural observation by the ER does not replace the testing and inspection requirements of the contract documents."

The objective is to obtain a general understanding whether the structure is in general conformance with the construction documents. Structural observation is not intended to consist of detailed or exhaustive inspections.

The SEAOC Guidelines suggest the following job site procedures:

- "Review Structural contract documents with the construction superintendent and others as appropriate, as part of the first visit to insure his/her familiarity with the documents.
- Observe construction, focusing primarily on critical or complex structural details.
- Discuss observations, corrections, or issues requiring direction with the construction superintendent and others as appropriate.

- Clarify lines of communication".

For the actual observation there is no cook book procedure to follow but rather a number of strategies that have been found effective:

- Walk the job site. Is what is being built consistent with your understanding? Step back and look at the building as a whole.
- Be open to the unexpected.
- Look at the other building systems such as electrical, plumbing, and mechanical. Does their layout impact the structural system? Are openings and block outs in walls and other structural elements what you expected?
- Look for problems that regularly occur on similar types of projects.
- Look for field fixes. These are often indicators of problems with the contractor's work or problems with the construction documents
- Look at work associated with RFI's. Is what you see consistent with your understanding? Are there similar problem areas that were not identified in the RFI's?
- Give extra attention to conditions that were problematic during detailing or in shop drawings.
- Where appropriate, spot check dimensions, number and spacing of fasteners, or other features for some members and connections.
- Ask the Contractor if there have been any problem areas.
- Meet with any special inspectors on site to get their impressions on the quality of the work and to understand how they are implementing the required inspections.

2.5 Common Structural Observation Issues

The actual strategies employed and what is observed (and when) will depend on the size and complexity of the project and what is found in the field as construction proceeds.
This section identifies some of the things to look for in different types of construction and discusses the timing/frequency of the structural observation site visits. This is a general discussion of issues that might be addressed during structural observation visits and does not attempt to cover all aspects of all types of construction.

2.5.1 Foundations

When: During the early stages of concrete work of some sophistication and at the engineer's discretion thereafter.

Foundation Issues:

- Footing layout.
- Anchor bolts and dowels.
- Footing formwork.
- Reinforcing steel cover, splicing, and congestion.
- Utility penetrations.
- Construction joints.

2.5.2 Steel Framing

When: After initial erection of the first section for larger projects, and after installation of most of the steel for smaller projects; during initial installation of steel deck; and at the engineer's discretion thereafter.

- Steel Observation Issues: Frame joints and protected zones.
- Trusses or long-span members.
- Penetrations through structural members and steel deck.
- Complex connections.
- Column splices.

2.5.3 Wood Framing

Wood presents several challenges including the tendency of carpenters to improvise, structural connections that are often complex, the likelihood that other trades will cut wood members after rough framing, and the lack of code required special inspections except in high wind regions or high seismic categories. The engineer's site visits and communications with the contractor and inspectors can help to meet these challenges.

When: During rough framing; prior to close up when the diaphragm and shear wall nailing is visible.

Wood Observation Issues:

- Member sizes, spacing, and grade.
- Diaphragm and shear wall nailing.
- Drags and collectors.
- Sole plate and double top plate nailing.

- Structural connection hardware.
- Notches or holes in wood members.

2.5.4 Concrete Construction

When: During the early stages of concrete work of some sophistication; and at the engineer's discretion thereafter.

Concrete Observation Issues:

- Formwork layout and dimensions.
- Formwork finishes.
- Sleeves and block outs for utility penetrations.
- Reinforcing steel cover, splicing, and congestion.
- PT tendon layout.
- Embedded items for fastening of other work.
- Quality of surface finish on previously placed concrete.

2.5.5 Masonry Construction

When: Early during the lay-up of wall; prior to the first grout pour; and at the engineer's discretion thereafter.

Masonry Observation Issues:

- Wall materials, sizes and bond.
- Reinforcing steel size and position.
- Sleeves, openings, blockouts, and lintels.
- Embedded items for fastening of other work.
- Grout space and cleanouts.

2.6 Non-compliance Items

While the code requires that the structural observer report at the conclusion of the project any deficiencies that were found but not resolved, the engineer should promptly report any deficiencies to the appropriate project personnel. As a minimum the deficiencies need to be promptly reported to the engineer's client. Depending upon the project rules either the engineer or his client should then notify contractor, special inspectors, and/or other members of the design team to ensure that the deficiencies can be promptly corrected and verified.

At the conclusion of the project the engineer will need to follow up with the inspectors to verify that the deficiencies have been corrected.

2.7 Structural Observation Reports

Although the CBC only requires reporting to the building department at the end of the project, a report should be prepared and distributed for each site visit. The report should note that the visit was a Structural Observation, and should indicate the status of construction, the work observed, and any deficiencies noted.

The site visit report needs to be followed up with the final report discussed in Chapter 4.

Chapter 3 - Construction Quality Assurance

Construction quality assurance consists of a number of activities aimed at giving the Owner, design professionals, and the regulatory agency some assurance that the project has been constructed in conformance with the requirements of the construction documents. Construction quality assurance includes but is not limited to submittal review, review of testing and inspection reports, site visits by the design professionals, structural observations, special inspection, and material testing.

The design professionals also play an important role in the quality assurance process. The professionals' work begins with the quality of the construction documents that they produce and follows with construction administration services including conducting preconstruction meetings, reviewing submittals, responding to questions from the contractor, resolving issues that arise during construction, and working with the special inspection agency on inspection issues. The following sections discuss the various ways the special inspector and the design professionals, in particular the structural engineer, participate in the construction administration process.

Some of the discussion in this chapter goes beyond code requirements, and possibly beyond the typical scope of the engineer's professional services contract. While not all clients will authorize these additional services, it is believed that an active role by the engineer in monitoring the inspection process can provide value to the owner that should be well worth the additional fees for the engineer.

It should be noted that the suggestions and recommendations discussed in this chapter are offered in an advisory capacity only and reflect the opinion solely of the authors. This chapter is not intended to define a standard of practice nor is it a commentary on the building code provisions. It should also be noted that the following discussion is based on the practices commonly used on construction projects in the San Francisco Bay Area for design bid build projects. Users of this document outside of this region should be aware that customs and standards in their area may differ.

3.1 Before Construction

3.1.1 Information on the Plans and Specifications

It is important that the construction documents are as complete and readable as possible. Drawings and/or specifications that are not complete or contain errors can create problems during construction and increase the possibility that the work may not be constructed correctly. Lack of coordination among the design disciplines is a common source of problems.

In addition, design professionals should always consider constructability when developing a design. The easier it is to build, the easier it is to inspect and the greater the chance that the design will be built correctly. If the contractor is brought on to the project during the design phase, a common practice on design build and "contractor at risk" projects, the design professional should solicit input from the contractor regarding construction means and sequencing issues that may inform the design solution.

The contract documents should include information, such as material strengths and tension test values, which are necessary for the contractor to perform the work and for the inspectors to inspect the work rather than in the inspection schedule which may not become part of the contract documents.

In addition to the technical requirements the construction documents also address administrative requirements related to testing and inspection. These provisions can include scheduling of tests and inspections as well as the contractor's responsibility for the cost of some tests and inspections.

Contract documents should address the need for the contractor to schedule and facilitate testing and inspection activities. The following language is an example of language that has been used on projects:

> "Schedule and coordinate all special inspections. Notify the special inspector at least 48 hours prior to performing any work requiring the inspector's presence. Provide access to the work, cause the work to remain exposed for inspection, and pay all costs associated with uncovering any work that has been covered without the required inspection."

Some materials tests, such as those required for unidentified steel or for reinforcing steel furnished without mill certification, are not part of the special inspection work. These tests are typically conducted and/or paid for by the contractor. This should be clarified in the specifications. Such testing may not be included in the statement of special inspections unless specifically required by the Code.

It is not uncommon to make the contractor contractually responsible for some of the costs of special inspection in cases where the contractor's actions greatly affect the owner's special inspection costs. Fabrication of steel in a shop outside of a day's travel, for example, would generate additional travel and subsistence costs for the special inspector. Specification language that back charges the contractor for a portion of the costs for inspections that take place more than a certain distance from the project site or in more than one fabrication facility can be used. This could result in higher fabrication costs for some manufacturers and higher bid costs.

Section 1704.4 of the CBC includes a requirement for a statement of contractor responsibility. This statement, which must be signed by each contractor responsible for the construction of either the seismic or wind load resisting system, states that each contractor acknowledges his awareness of the contents in the Statement of Special Inspections.

The CBC requires that the Statement of Contractor Responsibility be sent to the building official and owner prior to the commencement of the affected work. Some jurisdictions may require this statement as a condition to close out the project.

3.1.2 Preconstruction Meeting

Projects often have problems because the parties involved are unfamiliar with the project requirements or have not established effective lines of communication. A preconstruction meeting is an excellent way to avoid such problems during the work and delays in compliance approval at project completion. These meetings also provide an opportunity for the architect, structural engineer, special inspector, contractor, and the owner's representative to introduce themselves to one another. It would be ideal to have a preconstruction conference for every project, including smaller projects since even small projects can have problems. The increased special inspection requirements for wood and cold-formed steel framing, common with many small projects, are among the issues that could be addressed in a preconstruction meeting.

At a minimum, representatives of the architect, the structural engineer, the special inspector, the general contractor, and all relevant sub-contractors should attend this meeting. The building inspector for the governing jurisdiction should be invited to attend as well. Relevant sub-contractors could include the structural steel fabricator, the steel erector, the concrete sub-contractor, and/or the carpenter. It depends on the type of project, the inspections required, and other factors.

An agenda for such a meeting should include the following:

- Project special inspection requirements – Both the design professionals and the special inspector should emphasize any areas of special concern. The special inspector should also ask for clarification of any areas where the inspector is not sure of the requirements, particularly the extent of any periodic inspection and new inspection requirements.
- Submittals – Discuss the schedule for submission of contractor-generated submittals, how many copies of each submittal should be sent to the design team, the expected review time by the design professionals, and distribution of the reviewed submittals to all relevant parties including the special inspector. The contractor, special inspector, and design professionals should also discuss the process of submittal and review of any submittals that the special inspector will be reviewing concurrent with the design team, such as concrete mix designs and welding procedure specifications.
- Scheduling - Identify the process for scheduling inspections and structural observations. Determine the member of the contractor's team who will be responsible for contacting the special inspector and how much notice should be given prior to construction of work requiring inspections. Identify what construction requires structural observation and who will be contacting the structural engineer to schedule observation visits.
- Routing procedures – Determine the routing protocol for Requests for Information (RFIs) and other contractor questions. If an online construction

management program will be used, the contractor should introduce the program, discuss how the program is to be used, and outline the access protocol.

- Approved plans - Make sure that a set of approved plans stamped by the governing jurisdiction is available to special inspectors at the jobsite, preferably an additional set for their exclusive use. Make sure that design plans and shop drawings reviewed by the design professionals and/or the governing jurisdiction are available at offsite fabrication locations. If an additional set of plans is provided to the special inspectors, procedures for incorporating changes to the design into the special inspector's set should be established.
- Jurisdiction contact - Encourage communication between the jurisdiction building inspector and the special inspector. Obtain the name and phone number of the person the special inspector should contact to report work that is being covered without special inspection or other problems requiring building department intervention.
- Design professional contact - Specify conditions requiring notification and/or approval of the architect or other members of the design team. Determine the communication protocol for contact between the contractor, including the sub-contractors, and members of the design team. Determine if it is acceptable for the contractor and sub-contractors to contact the design consultants directly or if all contact should be routed through the prime design professional. Determine the communication protocol between the special inspector and the design team.
- Drawing revisions - Outline method for handling changes to the approved plans. Determine the procedure for obtaining jurisdiction approval of drawing revisions. Determine how change orders will be processed and the procedures the contractor will need to follow to obtain owner approval of change orders.
- Problem resolution - Delineate procedures and lines of communication for dealing with problems. Emphasize that non-compliance reports should be resolved by the contractor, with input from the design team if necessary, and any corrective work should be verified by the special inspector.
- Off-site work - Define and discuss any work requiring special inspection that will be performed at a location other than the jobsite.
- Construction schedule – Define and discuss the construction schedule. Determine if an accelerated schedule will be used and if so how that will impact the scheduling of special inspections. Define any work requiring special inspection that will be performed outside of normal work hours.
- Subcontracting - Identify any special inspection which will be subcontracted by the lead inspection agency, outline procedures for performance auditing, and verify jurisdiction approval.
- Reports - Define content, time frame, and distribution of the special inspection reports. Clarify who is to receive special inspection reports.
- Verify the procedure to be followed for final special inspection compliance approval.

3.2 During Construction

3.2.1 Communication

Communication during construction among the contractor, architect, structural engineer, special inspectors, and the building official is critical provided that each understands and respects the role of the others.

The crucial communications that need to take place include:

- Clarification of the construction documents (between contractor and architect/engineer);
- Clarification of special inspection requirements (between architect/engineer, contractor, inspector, and building official);
- Scheduling of inspections (between contractor and inspector);
- Results of inspections (inspector to contractor, architect, engineer, and building official);
- Notification of non-compliant items (inspector to contractor, and if not corrected, to architect, engineer and building official);

- Review and resolution of non-compliant items (engineer and architect to contractor, inspector and building official);
- Changes to the construction documents (engineer and architect to contractor, inspector, and building official);
- Notification of deficiencies found during structural observation visits, as discussed in Chapter 2.

Direct and immediate communication, such as a telephone call, an e-mail, or a fax, is advised in requesting clarification and reporting non-compliant items. Online construction management programs are also being used with increasing frequency. The communication procedures are best set up at the start of construction, preferably as part of the preconstruction meeting. The primary responsibility of notification of non-compliant construction is with the special inspector. When non-compliant construction is identified there should be direct communication among the architect, the engineer, the contractor, and the special inspector to discuss resolution of these issues. While this communication can be initiated by the architect, the engineer, or the contractor, the architect and engineer should not wait for the contractor to contact them, especially if the non-compliant construction involves a critical element of the structural system.

3.2.2 Reports

The special inspector provides inspection progress reports and material test reports for tests and inspections defined in the statement of special inspection. The architect and engineer prepare reports of site observations and structural observation reports.

The architect and engineer should review inspection reports to monitor the quality of the work and the nature of the inspection comments. This review should be done in a timely manner. Special attention should be paid to any items listed as not in compliance with the approved plans. Once notified of a non-compliant item, the architect and/or engineer should investigate the situation and offer a potential resolution of the issue. The contractor may also offer a resolution for the architect and engineer to consider. Care should be taken to distinguish between non-compliant work and work that is simply not completed.

A final report by on special inspections is required by the completion of the project. Refer to Chapter 4 for a more detailed discussion of this report.

3.2.3 Requests for Information (RFIs)

RFIs are the primary mode of communication between the contractor and the design team. The AISC *Code of Standard Practice* defines RFIs as "A written request for information or clarification generated during the construction phase of the project". Their primary uses are to clarify the contract documents, resolve discrepancies within the documents, resolve field conflicts and constructability issues, identify field conditions uncovered during construction, propose detail revisions to ease construction, request acceptance of proposed contractor's corrections to errors, and to confirm verbal communications.

RFIs are not intended to take the place of change orders or other submissions of revisions to construction documents as they are not contract documents.

Inspectors should not use RFIs to notify the design team of non-compliant items. However, the contractor can use RFIs to request acceptance of and/or repairs to non-compliant construction from the design team. The inspector should also receive from the contractor any RFI responses that affect the special inspection and testing for the project.

3.2.4 Changes in the Approved Plans

Changes in the work should take the form of amendments to the existing documents. The revised documents require building department approval and may require revised special inspection requirements. Copies should be provided to the architect, design engineer, building official, contractor, and special inspector.

Special inspections are required by the definition in Chapter 2 "…to ensure compliance with this code and approved construction documents". When the documents the inspector is using have not been approved by the building department the inspector's report should indicate that inspection was based on documents that are not approved by the building official.

Chapter 4 - Final Reports

The suggestions and recommendations discussed in this chapter are offered in an advisory capacity only and reflect the opinion solely of the authors. This chapter is not intended to define a standard of practice.

4.1 Special Inspection Final Report

Final reports are required from each entity providing special inspection, including testing agencies, independent special inspectors and the engineer if he or she performed any special inspections on the project.

Some jurisdictions require a final report for grading, excavation, or engineered fill, and for underpinning or shoring, before foundation construction starts; and for piling, drilled piers, or caissons before start of any work above grade.

As specified in CBC Section 1704.2.4, final special inspection reports are to be filed with the building official at a "point of time agreed upon by the permit applicant and the building official prior to the start of work". Typically, this "point of time" is between the end of construction and occupancy by the owner. Final reports are typically in the form of a letter which should state that work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans and specifications and the applicable workmanship provisions of the code. Items for which the agency/individual provided special inspection should also be listed. Construction not in conformance or unresolved inspection items should be noted on the final report as exceptions and described in detail.

Many discrepancies listed in progress special inspection reports are minor changes made to accommodate field conditions and approved verbally by the engineer or architect of record. These discrepancies should not be noted in the final report if the construction documents have been amended or if the issue has subsequently been resolved.

The building official may require that any exceptions or discrepancies listed in the final report be resolved before the report is accepted.

4.2 Structural Observation Final Report

The final structural observation report is a letter issued at the conclusion of construction stating "that the site visits have been made and identifying any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved" (CBC Section 1704.6). The report should be signed and sealed by the structural observer.

The final report should only list the items which were not resolved. An unresolved structural discrepancy may prevent the owner from obtaining an occupancy permit. Thus, it is essential that all discrepancies be resolved by the project team and when that is not feasible that the building official be consulted as soon as possible.

When the building department requires the engineer of record to submit a wet-signed structural observation form that the municipality has created, read the form carefully. Care should be taken in filling out the form not to confuse the structural observations with inspections.

Some jurisdictions also ask the engineer or architect of record for a final "sign-off" letter. This is not a CBC requirement. If such certification is required, it should be carefully worded to avoid giving the impression that the engineer is providing a guarantee that the work was performed and inspected in complete compliance with the plans and specifications. The following language may be appropriate: "Based upon our review of testing and inspection reports and job site observations, to the best of our knowledge the project has been constructed in general conformance with the intent of the contract documents."

Chapter 5 Statement of Special Inspections

The statement of special inspections (SSI) was introduced in California with the adoption of the 2007 CBC. The document is the outgrowth of an effort by CASE (Council of American Structural Engineers) to provide a uniform means of documenting the quality assurance requirements and has been required the IBC, although under a different name, since the 2000 edition.

In an effort to clarify the requirements of the CBC and promote uniformity of implementation the SEAONC Construction Quality Assurance Committee has produced the SEAONC Model Statement of Special Inspections (see Appendix A) that is available for download from the SEAONC web site (www.seaonc.org). This document is based on the CASE document and is consistent with the IBC guidelines on special inspection produced by the ICC.

The SSI is a change from past practices and there continues to be some confusion and resistance. Some jurisdictions are requiring the SSI be placed on the drawings while others are content for it to be a separate document. Similarly, many individuals see special inspections as being a structural issue only, and thus many architects, mechanical engineers, and electrical engineers continue to be ignorant of or ignore the relatively new provisions for architectural, mechanical, and electrical components. Over time these problems will need to be addressed by education, enforcement, and/or changes in the CBC.

These requirements have been successfully implemented by individuals and jurisdictions in California and other parts of the country with little or no problems.

Because of the variation in practices of different jurisdictions the engineer is encouraged to check with the local jurisdiction to determine local requirements. This document is limited to the provisions in the 2016 CBC as applied to buildings not under the jurisdiction of the DSA and OSHPD

5.1 What is in the Statement of Special Inspections?

The statement of special inspections (SSI) replaces the old testing and inspections forms but it goes further and addresses aspects of how the testing and inspections will be implemented. This is done by including a list of the testing agencies and special inspectors that will be performing the inspections, and a description of the seismic and wind force resisting systems. In addition the SSI often includes a cover document that summarizes several implementation issues and provides a mechanism to record the acceptance by the building official.

The purpose of special inspections is to provide the building official and the client paying for the work with some assurance that the work is performed in accordance to the Construction Documents. Because the owner pays for the special inspections directly they are not a part of the contractor's scope of work. The contractor's responsibilities related to special inspections are limited to notifying the owner's agent when work needing special inspections is ready for inspection and providing access and other assistance to the special inspectors so that they can perform their work.

One characteristic of the SEAONC Model Statement of Special Inspections is that each inspection and test is referenced to the specific code section where it is required. This should give the design professional and the building official better confidence that the provisions are being properly applied.

There is one SSI for the entire project. It is the intent that it be a separate document submitted along with the drawings, specifications, and permit application (Section 1704.2.3). The SSI is not a part of the owner/contractor agreement since the contractor is not actively involved in performing the required tests and inspections.

While the SSI is not a part of the contract between the owner and the contractor the contractor needs to be provided a copy of the SSI as a reference document in order to help him or her fulfill the associated obligations.

While some individuals may prefer to place the SSI on a drawing sheet, this can cause difficulties in incorporating the recommendations of different consultants and in obtaining the signatures by the client.

5.2 When is a Statement of Special Inspections Required?

A SSI is required whenever special inspection or testing is required by Sections 1704.2 and not exempted by Section 1704.2.3. An SSI is needed when a special inspection is required and vice versa.

Section 1704.2.3 exempts the need to prepare an SSI when the structure complies with the conventional light-frame construction provisions of Section 2308 and when the structure complies with the cold-formed steel light frame construction provisions of Section 2211.7. Where a structural engineer custom designs a local portion of a building otherwise conforming to the conventional construction provisions the SSI need only address the portion of the work that was engineered.

5.3 Who Prepares the SSI?

The question of who prepares the SSI has been a subject of much discussion. CBC Section 1704.3 states that it is to be prepared by the registered design professional in responsible charge. Section 107.3.4 of Division II of the CBC clarifies that the registered design professional in responsible charge is the prime design professional, typically the architect. The authors of this code provision required that the prime design professional on the project coordinate the preparation of the SSI since special inspections are now required for a number of systems designed by architects, mechanical engineers, and electrical engineers in addition to the structural engineer.

In preparing the SSI, the prime design professional would compile the special inspection recommendations from each of the consultants and produce a unified document. Thus, the design professional responsible for a specific system in the building needs to identify the inspections and tests applicable to his or her work and coordinate these requirements with the prime design professional. In addition, the prime design professional would work with the client to identify the testing agency and other special inspectors who will perform the special inspections and to obtain the client's signature on the appropriate forms. This process is similar to the compiling of the project manual that contains specification sections from multiple consultants.

The act of compiling the special inspection recommendations from each of the consultants is seen as a ministerial act by the prime design professional and as such would not make the prime design professional responsible for the technical content of the work prepared by others.

There is an exception in Section 1704.3 that allows the SSI to be prepared by "a qualified person approved by the building official" when a registered design professional did not design the work.

5.4 Who Submits the SSI?

The SSI is submitted by the permit applicant (Section 1704.2.3). This requirement that the SSI be submitted reflects the fact that it is seen as a separate document and not an integral part of the construction documents.

5.5 What is Included in the SSI?

The contents of the SSI are listed in Section 1704.3 and include identification of the elements of the building and components that are subject to special inspection, the types and extents of required special inspections, and additional requirements triggered by seismic or wind criteria.

Most model SSI's (ICC, CASE, and SEAONC) include a schedule of inspection agencies and inspectors, and a front page that summarizes certain code requirements and is signed by the building official, owner, and the registered design professional in responsible charge. This added schedule and front-end document were added to assist the building official in administering the quality assurance requirements and to clarify expectations. The space for descriptions of the seismic-force-resisting system and the wind-force-resisting system are provided to help identify these systems as required by CBC Sections 1705.11 and 1705.12.

Besides the special inspections and tests listed in the CBC, the SSI shall also list special inspections and tests required by either the building official or by the design professional responsible for each part of the work. Additional inspections and tests required by the building official should be limited to materials, systems, or products not addressed in the building code or referenced standards or when the materials or products are used in ways not contemplated in the building code. It is not the intent that the building official can require additional inspections and tests just because he or she personally believes the building code should be more restrictive.

When the design professional lists additional special inspections and tests in the SSI (Section 1704.3.1 item 1) they are subject to all of the requirements associated with the special inspections and tests listed in the CBC

and as such the building official is obligated to verify that they have been performed.

On most projects there will be tests and inspections that will not be considered special inspections and will not be listed in the SSI. For example, tests of moisture content of concrete slabs, floor levelness, and inspections by manufacturers' representatives would not be treated as special inspection.

The requirement that the SSI identify the type and extent of the special inspections and tests (Section 1704.3.1 Items 1, 2, and 3) requires clarification. The intent is that the SSI lists the inspections, tests and the materials that they are applicable to, as shown in the SEAONC Model SSI. The project specifications and/or drawing notes would provide more detail such as ASTM numbers, acceptance criteria, details of inspections and tests, and frequency of inspections and tests etc. The drawings help define which members the inspections and tests are applicable to by using the same nomenclature as used in the specifications. In some situations, notation will need to be added to the drawings to designate the seismic force resisting system, protected zones, and other elements that are subject to enhanced inspection requirements.

5.6 Special Requirements for Seismic Resistance (Sections 1705.12 and 1705.13)

Section 1704.3.2 in conjunction with Sections 1705.12 and 1705.13 requires that the SSI include additional requirements for various structural and non-structural systems.

The extent of special inspections for seismic resistance are specified in Sections 1705.12 and 1705.13. Section 1705.12 has several exceptions to the tests and inspections. These exceptions apply to short buildings where $S_{DS} \leq 0.5g$ and to all one or two-family dwellings not more than two stories in height.

It will be necessary to indicate the extent of these systems on the drawings, since contractors are not always able to discern the extent of the seismic-force-resisting system and components. In addition to the structural elements the architect and MEP engineers will need to identify specific architectural, mechanical and electrical components that are subject to inspection.

5.7 Special Requirements for Wind Resistance (Sections 1705.11)

The special inspections required for high winds are triggered when the wind Exposure Category is C or D and the basic wind speed is equal to or greater than 110 mph or when the wind Exposure Category is B and the basic wind speed is equal to or greater than 120 mph. Based on the mapped values in the CBC these conditions are not satisfied in Northern California. In California they are only applicable to certain areas in Southern California.

The detailed wind requirements are listed in Section 1705.11 and include inspections related to the building's wind-force-resisting system such as diaphragms, frames and shear walls, and inspections for the connections of wind resisting components such as wall and roof cladding.

Section 1704.3.3 requires the SSI to identify the main wind force resisting systems and "wind resisting components" in a manner similar to the seismic force resisting system.

5.8 How Do I Edit and Use the SSI?

Appendix B provides a protocol that provides guidance on how to work with the SEAONC Model Statement of Special Inspections that is in Appendix A.

5.9 Building Official and the Statement of Special Inspection

When the permit applicant submits the Statement of Special Inspection the plan checker will review it for conformance with the building code. If the plan checker believes that there are errors in the SSI he/she should notify the permit applicant so that the design professional can either modify the document or resolve the inspectors concern.

There have been reports of plan checkers making changes to the statement of special inspection without notifying the design professional. Such practices besides being inappropriate create problems at project closeout when it is determined that some of the required special inspections were not performed.

Appendix A:

SEAONC Model Statement of Special Inspections

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Statement of Special Inspections, 2016 CBC

Project: .....

Location: .....

This Statement of Special Inspections is submitted in fulfillment of the requirements of CBC Sections 1704. Included are:

- Schedule of Special Inspections and tests applicable to this project:
  - ☐ Special Inspections per Sections 1704 and 1705
  - ☐ Special inspections for Seismic Resistance
  - ☐ Special inspections for Wind Resistance
- List of the Testing Agencies and other special inspectors that will be retained to conduct the tests and inspections.

Special Inspections and Testing will be performed in accordance with the approved plans and specifications, this statement and CBC Sections 1704 and 1705.

The Schedule of Special Inspections summarizes the Special Inspections and tests required. Special Inspectors will refer to the approved plans and specifications for detailed special inspection requirements. Any additional tests and inspections required by the approved plans and specifications will also be performed.

Interim reports will be submitted to the Building Official and the Registered Design Professional in Responsible Charge in accordance with CBC Section 1704.2.4.

A Final Report of Special Inspections documenting required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy (Section 1704.2.4). The Final Report will document:

- Required special inspections.
- Correction of discrepancies noted in inspections.

The Owner recognizes his or her obligation to ensure that the construction complies with the approved permit documents and to implement this program of special inspections. In partial fulfillment of these obligations, the Owner will retain and directly pay for the Special Inspections as required in CBC Section 1704.2.

This plan has been developed with the understanding that the Building Official will:

- Review and approve the qualifications of the Special Inspectors who will perform the inspections.
- Monitor special inspection activities on the job site to assure that the Special Inspectors are qualified and are performing their duties as called for in this Statement of Special Inspection.
- Review submitted inspection reports.
- Perform inspections as required by the local building code.

Prepared by:

Registered Design Professional in Responsible Charge

Signature Date

Owner's Authorization:

Owner

Signature Date

Building Official's Acceptance:

Building Official

Signature Date

Schedule of Inspection, Testing Agencies, and Inspectors

The following are the testing agencies and special inspectors that will be retained to conduct tests and inspection on this project.

Responsibility	Firm	Address, Telephone, e-mail
1. Special Inspection (except for geotechnical)	*To Be Determined*	
2. Material Testing	*To Be Determined*	
3. Geotechnical Inspections	*To Be Determined*	
4.	*To Be Determined*	

Seismic Requirements (Section 1704.3.2)

Identify seismic-force-resisting system and designated seismic systems subject to special inspections as per Section 1705.12:

The extent of the seismic-force-resisting system is defined in more detail in the construction documents.

Wind Requirements (Section 1704.3.3)

Identify main wind-force-resisting system and designated wind resisting components subject to special inspections in accordance with Section 1705.11:

The extent of the main wind-force-resisting system and wind resisting components is defined in more detail in the construction documents.

Schedule of Special Inspections and Tests

2016 California Building Code

Notation Used in Table:

Column headers:

- C — Indicates continuous inspection is required.
- P — Indicates periodic inspections are required. The notes below and/or contract documents should clarify.

Box entries:

- X — Is placed in the appropriate column to denote either "C" continuous or "P" periodic inspections.
- --- — Denotes an activity that is a one-time activity.
- Std — Indicates that the standard defines frequency.

Additional detail regarding inspections and tests are provided in the project specifications or notes on the drawings.

Special Inspections and Tests	C	P	Notes	
1705.1.1 – Special Cases				
1705.2 – Steel Construction				
1705.2.1 – Structural steel				
1. Review material test reports and certifications (AISC 360 N5.2)	---			
2. Inspection of welding (AISC 360 N5.4)	Std			
3. NDT of welded joints (AISC 360 N5.5)		X		
4. Inspection of high strength bolting (AISC 360 N5.6)	Std			
5. Verify compliance of steel members with details on construction documents (AISC 360 N5.7)		X		
6. Headed studs and anchors (AISC 360 N6)	Std			
1705.2.2 Cold-formed steel deck				
1. Review material test reports and certifications (SDI QA/QC 4.2.B)	---			
2. Verify deck materials (SDI QA/QC 6.1.A)	---			
3. Verify deck and accessory installation (SDI QA/QC 6.1.D)		X		
4. Inspect deck welding (SDI QA/QC 6.1.B and Tables 1.3, 1.4, and 1.5)	Std			
5. Inspect mechanical fastening of deck (SDI QA/QC 6.1.C and Tables 1.6, 1.7, and 1.8)	Std			
1705.2.3 –Open-web steel joists and joist girders				
1. Installation of open-web steel joists and joist girders				
a. End connections – welding or bolted		X		
b. Bridging – horizontal or diagonal.				
1. Standard bridging		X		
2. Bridging that differs from the SJI specifications listed in Section 2207.1		X		
1705.2.4 – Cold formed steel trusses spanning 60 feet or greater				
Verify temporary installation restraint/bracing and the permanent individual truss member bracing are installed in accordance with the approved truss submittal package.		X		
1705.3 Concrete				
Table 1705.3 – Concrete Construction				
1. Inspection of reinforcing steel, including prestressing tendons and placement		X		
2. Reinforcing bar welding				
a. Verify weldability if not ASTM A706		X		
b. Single pass fillet welds max 5/16"		X		

Special Inspections and Tests	C	P	Notes	
c. Inspect other welds	X			
3. Inspection of anchors cast in concrete		X		
4. Inspection of anchors installed in hardened concrete.				
a. Adhesive anchors horizontally or upward inclined	X			
b. Mechanical anchors and other adhesive anchors		X		
5. Verify use of required design mix		X		
6. Prior to concrete placement fabricate specimens for strength tests, perform slump and air content tests and determine the temperature of the concrete	X			
7. Inspect concrete and shotcrete placement for proper application techniques	X			
8. Verify maintenance of specified curing temperature and techniques		X		
9. Inspect prestressed concrete for:				
a. Application of prestressing forces, and	X			
b. Grouting of bonded prestressing tendons	X			
10. Inspect erection of precast concrete members		X		
11. Verify in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to removal of shores and forms from beams and structural slabs		X		
12. Inspect formwork for shape, location, and dimensions of the concrete member being formed		X		
ACI 318-14 Section 26.12: Compressive tests of specimens taken during concrete placement		X		
1705.4 – Masonry Construction				
Level A Masonry Inspections				
1. Verify compliance with approved submittals.				
Level B Masonry Inspections (TMS 602 Table 4)				
A. Verification of slump flow and VSI as delivered to the site for self-consolidating grout		X		
B. Verification of f'_m and f'_{AAC} prior to construction		X		
1. Verify compliance with approved submittals		X		
2. As masonry construction begins, the following are in compliance:				
a. Proportions of site-prepared mortar		X		
b. Construction of mortar joints		X		
c. Grade and size of prestressing tendons and anchorages		X		
d. Location of reinforcement, connectors, prestressing tendons, and anchorages		X		
e. Prestressing technique		X		
f. Properties of thin-bed mortar for AAC masonry	X	X		
3. Prior to grouting the following verify the following are in compliance:				
a. Grout space		X		
b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons, and anchorages		X		
c. Placement of reinforcement, connectors, and prestressing tendons and anchorages		X		
d. Proportions of site-prepared grout and prestressing grout for bonded tendons		X		
e. Construction of mortar joints		X		
4. Verify during construction:				
a. Size and location of structural elements.		X		
b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction		X		
c. Welding of reinforcement	X			

Special Inspections and Tests	C	P	Notes	
d. Preparation, construction and protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperature above 90 degrees F)		X		
e. Application and measurement of prestressing force	X			
f. Placement of grout and prestressing grout for bonded tendons is in compliance	X			
g. Placement of AAC masonry units and construction of thin-bed mortar joints	X	X		
5. Observe preparation of grout specimens, mortar specimens, and/or prisms		X		
Level C Masonry Inspections (TMS 602 Table 5)				
A. Verification of f'_m and f'_{AAC} prior to construction and for every 5,000 square feet during construction		X		
B. Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout as delivered to the site		X		
C. Verification of slump flow and Visual Stability Index (VSI) as delivered to the project site		X		
1. Verify compliance with the approved submittals		X		
2. Verify the following are in compliance:				
a. Proportions of site-mixed mortar, grout, and prestressing grout for bonded tendons		X		
b. Grade, type, and size of reinforcement and anchor bolts, prestressing tendons and anchorages		X		
c. Placement of masonry units and construction of mortar joints		X		
d. Placement of reinforcement, connectors and prestressing tendons and anchorages	X			
e. Grout space prior to grouting	X			
f. Placement of grout and prestressing grout for bonded tendons is in compliance	X			
g. Size and location of structural elements		X		
h. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction	X			
i. Welding of reinforcement	X			
j. Preparation, construction, and protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperature above 90 degrees F)		X		
k. Application and measurement of prestressing force	X			
l. Placement of AAC masonry units and construction of thin-bed mortar joints	X			
m. Properties of thin-bed mortar for AAC masonry.	X			
3. Observe preparation of any grout specimens, mortar specimens, and/or prisms	X			
Masonry Testing				
TMS 602, Section 1.4.B.2: Masonry units – Sample and test		X		
TMS 602, Section 1.4.B.3: Masonry Prisms – Form and test.		X		
TMS 602 Section 2.2B: Grout – Sample and test.		X		
1705.5 - Wood Construction				
1. Inspect prefabricated wood structural elements and assemblies in accordance with Section 1704.2.5		X		
Inspect site built assemblies		X		
1705.5.1 - Inspect high-load diaphragms:				
1. Verify grade and thickness of sheathing.		X		

Special Inspections and Tests	C	P	Notes	
2. Verify nominal size of framing members at adjoining panel edges.		X		
3. Verify: a. Nail or staple diameter and length b. Number of fastener lines c. Spacing between fasteners in each line and at edge margins		X		
1705.5.2 – Metal-plate-connected wood trusses spanning 60 feet or greater:		X		
Verify temporary installation restraint/bracing and the permanent individual truss member bracing are installed in accordance with the approved truss submittal package		X		
1705.6 - Soils				
Table 1705.6 – Soils				
1. Verify materials below shallow foundations are adequate to achieve the desired bearing capacity		X		
2. Verify excavations are extended to proper depth and have reached proper material		X		
3. Perform classification and testing of compacted fill materials		X		
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	X			
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly		X		
1705.7 – Driven Deep Foundations				
Table 1705.7 –Deep Driven Foundation Elements				
1. Verify element materials, sizes and lengths comply with the requirements	X			
2. Determine capacities of test elements and conduct additional load tests, as required	X			
3. Inspect driving operations and maintain complete and accurate records for each element	X			
4. Verify locations of piles and their plumbness: a. Confirm type and size of hammer b. Record number of blows per foot of penetration c. Determine required penetrations to achieve design capacity d. Record tip and but elevations and document any damage to foundation elements	X			
5. For steel elements, perform additional special inspections in accordance with Section 1705.2				
6. For concrete elements and concrete filled elements, perform tests and additional special inspections in accordance with Section 1705.3				
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge				
1705.8 – Cast-in-place Deep Foundations				
Table 1705.8 - Special Inspections and Tests of Cast-in-Place Deep Foundation Elements				
1. Inspect drilling operations and maintain complete and accurate records for each element	X			
2. Verify placement locations and plumbness. Confirm: a. Element diameters b. Bell diameters (if applicable) c. Lengths, embedment into bedrock (if applicable) d. Adequate end strata bearing capacity. Record concrete or grout volumes	X			

Special Inspections and Tests	C	P	Notes	
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3				
1705.9 – Helical Pile Foundations				
Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque	X			
1705.11 – **Special Inspections for Wind Resistance**				
1705.11.1 – Structural wood				
1. Inspect field gluing operations of elements of the wind-force-resisting system.	X			
2. Inspect nailing, bolting, anchoring, and other fastening of elements of the main wind-force-resisting system, including: a. Wood shear walls b. Wood diaphragms c. Drag struts, braces d. Hold-downs		X		
1705.11.2 – Cold-formed steel light-frame construction				
1. Welding of elements of the main wind-force-resisting system		X		
2. Inspection of screw attachments, bolting, anchoring, and other fastening of elements of the main wind-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs		X		
1705.11.3 – Wind-resisting components				
1. Roof covering, roof deck, and roof framing connections		X		
2. Exterior wall coverings and wall connections to roof and floor diaphragms and framing		X		
1705.12 – **Special Inspections for Seismic Resistance**				
1705.12.1 – **Structural steel**				
Special inspection for both structural steel and structural steel elements in accordance with the quality assurance requirements of AISC 341				
1. Visual Weld Inspection (AISC 341 J6.1)	**Std**			
3. High strength bolting (AISC 341 J7)	**Std**			
4. Protected zones (AISC 341 J8)	**Std**			
5. Reduced beam sections (AISC 341 J8)	**Std**			
6. H piles (AISC 341 J10)	**Std**			
1705.12.2 - **Structural wood**				
1. Inspect field gluing operations of elements of the seismic-force-resisting system	X			
2. Inspect nailing, bolting, anchoring, and other fastening of elements of the seismic-force-resisting system, including: a. Wood shear walls b. Wood diaphragms c. Drag struts, braces d. Shear panels e. Hold-downs		X		
1705.12.3 - **Cold-formed steel light-frame construction**				
1. Welding operations of elements of the seismic-force-resisting system		X		
2. Inspection of screw attachments, bolting, anchoring, and other fastening of elements of the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs		X		
1705.12.4 – **Designated seismic system**				
Verify that the equipment label, anchorage and mounting conforms to the certificate of compliance for systems requiring seismic qualification		X		
1705.12.5 – **Architectural components**				

Special Inspections and Tests	C	P	Notes	
1. Inspect erection and fastening of exterior cladding		X		
2. Inspect erection and fastening of veneer		X		
3. Inspect erection and fastening of exterior non-bearing walls		X		
4. Inspect erection and fastening of interior non-bearing walls		X		
1705.12.5.1 – Anchorage of access floors		X		
1705.12.6 – Plumbing, mechanical and electrical components				
1. Inspect anchorage of electrical equipment for emergency or stand-by power systems		X		
2. Inspect anchorage of non-emergency electrical equipment		X		
3. Inspect installation and anchorage of piping systems and associated mechanical units carrying hazardous materials		X		
4. Inspect installation and anchorage of ductwork that contains hazardous materials		X		
5. Inspect installation and anchorage of vibration isolation systems		X		
1705.12.7 – Storage racks 8 feet or greater				
Inspect anchorage		X		
1705.12.8 – Seismic isolation system:				
Inspection of isolation system during fabrication and installation		X		
1705.12.9 – Cold-formed steel special bolted moment frames		X		
1705.13 Testing for Seismic Resistance				
1705.13.1 – Structural Steel				
For both structural steel and structural steel elements in seismic force resisting systems perform NDT per AISC 341	Std			
1705.14 – Sprayed Fire-Resistant Materials				
1705.14.1 – Physical and visual tests				
1. Condition of substrates				
a. Inspect surface for accordance with the approved fire-resistance design and the approved manufacturer's written instructions		X		
b. Verify minimum ambient temperature before and after application		X		
c. Verify ventilation of area during and after application		X		
2. Measure average thickness per ASTM E605 and Section 1705.14.4		X		
3. Verify density of material for conformance with the approved fire-resistant design and ASTM E605. (Ref. Section 1705.14.5)		X		
4. Test cohesive/adhesive bond strength per Section 1705.14.6		X		
5. Condition of finished application		X		
1705.15 – Mastic and Intumescent Fire-Resistant Coating		X		
1705.16 – Exterior Insulation and Finish Systems (EIFS).				
1705.16.1 Water-resistive barrier coating				
Inspect when installed over a sheathing substrate		X		
1705.17 – Fire-resistant penetrations and joints				
1705.17.1 – Penetration firestops		X		
1705.17.2 – Fire-resistant joint systems		X		
1705.18 – Smoke Control System		X		

Appendix B: Protocol for the Editing and Use of the Statement of Special Inspections

The statement of special inspections addresses quality assurance tests and inspections that the owner is responsible for having performed under the 2016 edition of the *California Building Code*. The items addressed in the statement of special inspections typically fall within the purview of several design professionals and its preparation is thus a group activity. The prime design professional, typically the architect, will prepare this document with the assistance of the consultants affected. Where there are multiple consultants specifying the same materials or systems, such as both the civil engineer and the structural engineer specifying concrete, their efforts need to be coordinated.

The statement of special inspections is a document separate from the drawings and specifications. It is a permit document but not a construction document, and is not a part of the owner/contractor agreement although the Contractor should be made aware of its contents.

The following list summarizes the tasks associated with the preparation and use of the Statement of Special Inspections:

1. Using these guidelines, the SEAONC Model Statement of Special Inspection document, and the building code determine what special inspections are required.
2. Denote on the Construction Documents the extent of the members and components that will be subjected to the tests and special inspections.
3. Delete the items in the schedule of special inspections that are not applicable. When deleting items do not change the numbering of the items. This will make it easier for the plan checker to verify which items have been deleted.
4. Add special inspections and tests to the schedule of special inspections for products and materials not addressed in the prototype document.
5. Add any special inspections recommended by the design professional.
6. Verify that the project specifications and notes placed on the drawings clarify the details of the tests and special inspections to be performed.
7. Do not edit the text associated with individual items. Use the Notes column to clarify. References to specification sections or notes on the drawings are preferred to placing detailed requirements in the schedule. This information will typically need to be denoted graphically.
8. If applicable provide a description of seismic force resisting system and the main wind force resisting systems.
9. Fill out the schedule of inspection, testing agencies, and inspectors. In some cases, these cannot be filled out at the time the project is submitted for review. In such cases the permit might not be issued until these items can be filled in.
10. Complete the agreement that is the first page of the statement of special inspections. This is typically filled out and signed by the design professional in responsible charge. This agreement requires the signature of the owner.
11. Submit the statement of special inspections as a part of the submittal to the building department for review.
12. The building official will sign the statement of special inspections if it is found acceptable and make it a permit document.
13. When deferred approvals or changes to the documents are submitted to the building official, the design professional preparing the revised documents should evaluate the need to modify the statement of special inspections; and if an update is appropriate, the design professional should submit the proposed modification. When a deferred approval item is to be designed by a design professional hired by the contractor, the specifications should charge him with recommending any necessary changes to the SSI and with monitoring the results of the relevant special inspections.

14. Provide the contractor with a copy of the statement of special inspections so that the contractor can coordinate with and facilitate the required tests and inspections.
15. During construction the inspection and testing agencies will use the statement of special inspections along with the drawings and specifications to determine the special inspection requirements. Note that there may be tests and inspections that are not considered special inspections.
16. The owner should assign an individual or firm the responsibility of coordinating the special inspection program. This will greatly facilitate compliance with the requirement for a final report.
17. At the end of the project, the owner (with the assistance of the design consultants) and the special inspection and testing agencies will submit a final report to the building official. The building official will review the final report in the context of the agreed statement of special inspections and, if appropriate, issue a certificate of occupancy.

In addition, the following quality assurance activities need to be coordinated:

1. Verify that the project specifications require the contractor to sign a statement of responsibility as required per 2016 CBC Section 1704.4 and verify that the document is signed.
2. Coordinate with the structural engineer the nature and extent of the any required structural observations.

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