

CHAPTER 6 STRUCTURAL STEEL

SICC-601 GENERAL

SICC-601.1 Scope. The requirements of this chapter and NCSBC-1704.3 shall apply when construction includes structural hot-rolled steel building elements as listed in SICC-302.2. Where required, structural hot-rolled steel building elements shall also comply with NCSBC-1705, NCSBC-1707 and NCSBC -1708. See SICC-2007 Chapter 14 for sprayed fire-resistant materials.

SICC-601.2 Steel fabrication. Structural steel fabricators shall be subject to special inspections as required by SICC-302.1 and SICC-603 and NCSBC -1704.2.

SICC-601.3 Steel erection. Structural steel elements shall be subject to special inspections as required by SICC-604. Construction shall conform to the AISC Code of Standard Practice.

SICC-602 FABRICATION AND ERECTION DOCUMENTS

SICC-602.1 Review and approval. The structural steel fabrication and erection documents shall be submitted for review and approval to the **SER** prior to fabrication and erection of steel elements. The **GC** shall provide **SER**-approved fabrication and erection documents for use by the **SIER** to conduct special inspections during construction.

SICC-602.2 Preparation of fabrication and erection documents. The structural steel fabrication and erection documents shall include designs and details for welded and bolted connections. Details for welded connections shall clearly indicate the seismic-force-resisting elements of buildings of Seismic Category C,D,E or F. Details for bolted connections shall clearly indicate the type of connection used in the design (bearing or slip-critical), the amount of tensioning required (snug tight or fully tensioned) and the ASTM specifications for the bolts, nuts and washers

SICC-602.3 SER review and approval. The structural steel fabrication and erection documents shall be reviewed and approved by the **SER**. Each fabrication and erection document shall bear the review and approval stamp of the **SER** and be properly signed and dated.

a. Secondary structural elements. Secondary structural elements are required to be reviewed and approved by the **SER** only for their effects on the primary structural system.

SICC-603 INSPECTION OF STEEL FABRICATORS

SICC-603.1 Steel fabricators. The **SIER** shall provide special inspection of the steel fabricator and fabrication procedures, and of the fabricated items, as required by IBC-1704.2 (see SICC-302.1).

SICC-603.2 Fabrication procedures.

a. Certification. The fabricator may demonstrate to the **SIER** that the requirements of IBC-1704.2 have been met by furnishing evidence of compliance with the AISC Quality Certification Program in the appropriate category.

b. Procedures implementation. The **SIER** shall verify in writing to **CCBSD** that the fabricator is

properly implementing the fabrication and quality control procedures outlined above. Verification may be on a job basis or by inspection within the previous twelve months.

SICC-604 INSPECTION OF STEEL ELEMENTS

SICC-604.1 Material receiving. The **SIER** shall inspect steel elements, welding material, and high strength bolts for conformance with NCSBC -Table 1704.3.

SICC-604.2 Steel elements. The **SIER** shall inspect steel elements in accordance with NCSBC-1704.3.

NCSBC -1704.3 Steel construction. The special inspections for steel elements of buildings and structures shall be as required by Section 1704.3 and Table 1704.3. Where required, special inspection of steel shall also comply with Section 1715.

Exceptions:

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

2. The special inspector need not be continuously present during welding of the following items, provided the materials, welding procedures and qualifications of welders are verified prior to the start of the work; periodic inspections are made of the work in progress; and a visual inspection of all welds is made prior to completion or prior to shipment of shop welding.

2.1. Single pass fillet welds not exceeding $\frac{5}{16}$ inch (7.9 mm) in size.

2.2. Floor and roof deck welding.

2.3. Welded studs when used for structural diaphragm.

2.4. Welded sheet steel for cold-formed steel framing members such as studs and joists.

2.5. Welding of stairs and railing systems.

NCSBC-1704.3.1 Welding. Welding inspection shall be in compliance with AWS D1.1. The basis for welding inspector qualification shall be AWS D1.1.

NCSBC -1704.3.2 Details. The special inspector shall perform an inspection of the steel frame to verify compliance with the details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint details at each connection.

NCSBC-1704.3.3 High-strength bolts. Installation of high strength bolts shall be periodically inspected in accordance with AISC specifications.

NCSBC-1704.3.3.1 General. While the work is in progress, the special inspector shall determine that the requirements for bolts, nuts, washers, and paint; bolted parts; and installation and tightening in such standards are met. For bolts requiring pretensioning, the special inspector shall observe the pre-installation testing and calibration procedures when such procedures are required by the installation method or by project plans or specification; determine that all plies of connected materials have been drawn together and properly snugged; and monitor the installation of bolts to verify that the selected procedure for installation is properly used to tighten bolts. For joints required to be tightened only to the snug tight condition, the special inspector need only verify that the connected materials have been drawn together and properly snugged.

NCSBC-1704.3.3.2 Periodic monitoring. Monitoring of bolt installation for pretensioning is permitted to be performed on a periodic basis when using the turn-of-nut method with matchmarking techniques, the direct tension indicator method, or the alternate design fastener (twist-off bolt) method. Joints designated as snug tight need be inspected only on a periodic basis.

NCSBC-1704.3.3.3 Continuous monitoring. Monitoring of bolt installation for pretensioning using the calibrated wrench method or the turn-of-nut method without matchmarking shall be performed on a continuous basis.

SICC-604.3 Special Inspections for Seismic Resistance. The **SIER** shall inspect steel elements in accordance with NCSBC-1707.

NCSBC-1707.1 Special inspections for seismic resistance. Special inspection as specified in this section is required for the following, where required in Section 1704.1. Special inspections itemized in Sections 1707.2 through 1707.8 are required for the following: 1. The seismic-force-resisting systems in structures assigned to Seismic Design Category C, D, E or F, as determined in Section 1616.

NCSBC-1707.2 Structural steel. Continuous special inspection for structural welding in accordance with AISC 341.

Exceptions:

1. Single-pass fillet welds not exceeding 5/16 inch (7.9 mm) in size.
2. Floor and roof deck welding.

NCSBC-1707.4 Cold-formed steel framing. Periodic special inspections during welding operations of elements of the seismic- force-resisting system. Periodic special inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system, including struts, braces, and hold-downs.

**NCSBC-TABLE 1704.3
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION**

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD ^a	NCSBC REFERENCE
1. Material verification of high-strength bolts, nuts, and washers:			Applicable ASTM material specifications;	
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	AISC 335, Section A3.4; AISC LRFD, Section A3.3	—
b. Manufacturer's certificate of compliance required.		X		
2. Inspection of high-strength bolting:			AISC LRFD, Section M2.5	1704.3.3
a. Bearing-type connections.		X		
b. Slip-critical connections.	X	X		
3. Material verification of structural steel:				1708.4
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	-	-	ASTM A 6 or ASTM A 568	
b. Manufacturers' certified mill test reports required.	—	—	ASTM A 6 or ASTM A 568	
4. Material verification of weld filler materials:				
a. Identification markings to conform to AWS specification in the approved construction documents.			AISC ASD, Section A3.6; AISC LRFD, Section A3.5	
b. Manufacturer's certificate of compliance required.	—	—		—
5. Inspection of welding:			AWS D1.1	1704.3.1
a. Structural steel:				
1) Complete and partial penetration groove welds	X			
2) Multi-pass fillet welds	X			
3) Single-pass fillet welds $> \frac{5}{16}$ " (7.9 mm)	X			
4) Single-pass fillet welds $\leq \frac{5}{16}$ " (7.9 mm)		X		
5) Floor and deck welds		X	AWS D1.3	
b. Reinforcing steel:			AWS D1.4	1704.3.1
1) Verification of weldability of reinforcing steel other than ASTM A 706.		X	ACI 318: 3.5.2	
2) Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special reinforced concrete shear walls, and shear reinforcement.	X			
3) Shear reinforcement.		X		
4) Other reinforcing steel.	X			
6. Inspection of steel frame joint details for compliance with approved construction documents:		X		1704.3.2
a. Details such as bracing and stiffening.	—		—	
b. Member locations.				
c. Application of joint details at each connection.				

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1707.1, Special inspection for seismic resistance.

SICC-604.3 Erection. The **SIER** shall perform special inspections of anchor bolts, bolts, welding, connections, and details. Any observed discrepancies between the County approved construction documents and the **SER** approved structural steel fabrication and erection documents shall be brought to the immediate attention of the **SER**. All steel elements shall be inspected before they are covered by sprayed fire-resistant materials, or are otherwise concealed.

a. High strength bolts. Installation shall conform to the County approved construction documents, **SER** approved structural steel fabrication and erection documents, and the RCSC/AISC *Specification for Structural Joints Using A325 or A490 Bolts*.

In the event any bolt, nut, or washer is broken during normal installation (except bolts purposely over-torqued in order to draw the parts together), the **SIER** shall bring such failures to the immediate attention of the **SER** and **CCBSD**. The **SIER** shall observe the on-job-site proof load testing of any suspect bolt(s) per ASTM and AISC standards. Should the bolts fail load testing, they shall be rejected and the **SER** shall make recommendations in writing for remedial actions. All test results and recommendations shall be reported to **CCBSD**.

b. Welding. All welders and weld special inspectors shall be certified in accordance with AWS D1.1. Weld inspection shall be in conformance with NCSBC-1704.3.1 and NCSBC-Table 1704.3 Item 5.

c. Rigid or semi-rigid connections. When field welding of rigid or semi-rigid connections is required, or when bolted connections are required to meet a minimum pretension beyond snug tight, the **SIER** shall conduct special inspections of the connections.

d. Details: The **SIER** shall perform inspections of the steel frame to verify compliance with the details shown on the County approved construction documents and the **SER** approved fabrication and erection documents, such as bracing, stiffening, member locations, and proper application of joint details at each connection.

SICC-605 COMPLETION OF STRUCTURAL STEEL CONSTRUCTION

Upon completion of structural steel construction, including connections, the **SIER** shall submit a completion letter to **CCBSD**. **THE SIER** shall also indicate the date of completion on the final report of special inspections for structural steel construction.

Structural Steel (Council of American Structural Engineer's Guide)

Item	Scope
1. Fabricator Certification/ Quality Control Procedures <input type="checkbox"/> Fabricator Exempt	<i>Review shop fabrication and quality control procedures.</i>
2. Material Certification	<i>Review certified mill test reports and identification markings on wide-flange shapes, high-strength bolts, nuts and welding electrodes</i>
3. Open Web Steel Joists	<i>Inspect installation, field welding and bridging of joists.</i>
4. Bolting	<i>Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. Continuous inspection of bolts in slip-critical connections.</i>
5. Welding	<i>Visually inspect all welds. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet welds.</i> <i>Ultrasonic testing of all full-penetration welds.</i>
6. Shear Connectors	<i>Inspect size, number, positioning and welding of shear connectors. Inspect studs for full 360 degree flash. Ring test all shear connectors with a 3 lb hammer. Bend test all questionable studs to 15 degrees.</i>
7. Structural Details	<i>Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.</i>
8. Metal Deck	<i>Inspect welding and side-lap fastening of metal roof and floor deck.</i>
9. Other:	