

## CHAPTER 9 MASONRY

### SICC-901 GENERAL

**SICC-901.1 Scope.** The requirements of this chapter and NCSBC-1704.5 shall apply when construction includes masonry building elements as listed in SICC-302.5. All masonry construction shall comply with NCSBC-2104 (see SICC-1004 for construction in cold or hot weather).

### SICC-902 FABRICATION AND ERECTION DOCUMENTS

The masonry fabrication and erection documents, including construction bracing designs and mortar and grout mix designs, shall be submitted for review and approval to the **AR**, **SER** prior to masonry construction. The **GC** shall provide **AR/SER**-approved fabrication and erection documents for use by the **SIER** to conduct special inspections during construction.

### SICC-903 SPECIAL INSPECTIONS

The **SIER** shall perform special inspections of masonry construction, for conformance with County approved documents and in accordance with NCSBC-1704.5, NCSBC-Table 1704.5.1, and NCSBC-Table 1704.5.3, depending upon the classification of the building or structure as an “essential” or “nonessential” facility and the type of masonry design as “empirical” or “engineered” masonry. (An “essential” facility usually means occupancy for disaster prevention or response, and “engineered” masonry usually means structural loadbearing masonry.)

**NCSBC-1704.5 Masonry construction.** Masonry construction shall be inspected and evaluated in accordance with the requirements of this section, depending on the classification of the building or structure or nature of occupancy, as defined by this code (see Tables 1604.5 and 1616.2).

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

1. Empirically designed masonry, glass unit masonry, or masonry veneer designed by Section 2109, 2110, or ACI 530/ASCE 5/TMS 402 Chapters 5, 6 or 7 when they are part of nonessential buildings (see Tables 1604.5 and 1616.2).
2. Masonry foundation walls constructed in accordance with Table 1805.5(1), 1805.5(2), 1805.5(3) or 1805.5(4).

**NCSBC-1704.5.1 Empirically designed masonry, glass unit masonry and masonry veneer in essential facilities.** The minimum inspection program for masonry designed by Chapter 14, Section 2109 or 2110, or by Chapter 5, 6 or 7 of ACI 530/ASCE 5/TMS 402, in essential facilities (see Table 1604.5 and Section 1616.2) shall comply with Table 1704.5.1.

**NCSBC-1704.5.2 Engineered masonry in nonessential facilities.** The minimum special inspection program for masonry designed by Section 2106, 2107 or 2108, or by chapters other than Chapters 5, 6, or 7 of ACI 530/ASCE5/TMS 402, in nonessential facilities (see Table 1604.5 and Section 1616.2) shall comply with Table 1704.5.1.

**NCSBC-1704.5.3 Engineered masonry in essential facilities.** The minimum special inspection program for masonry designed by Section 2106, 2107 or 2108, or by chapters other than Chapters 5, 6 or 7 of ACI 530/ASCE5/TMS 402, in essential facilities (see Tables 1604.5 and 1616.2) shall comply with Table 1704.5.3.

**NCSBC-TABLE 1704.5.1  
LEVEL 1 SPECIAL INSPECTION**

INSPECTION TASK	FREQUENCY OF INSPECTION		REFERENCE FOR CRITERIA		
	Continuous during task listed	Periodically during task listed	NCSBC section	ACI 530 / ASCE 5 / TMS 402 <sup>a</sup>	ACI 530.1 / ASCE 6 / TMS 602 <sup>a</sup>
1. As masonry construction begins, the following shall be verified to ensure compliance:					
a. Proportions of site prepared mortar.	—	X	—	—	Art. 2.6A
b. Construction of mortar joints.		X			Art. 3.3B
c. Location of reinforcement and connectors.		X			Art. 3.4, 3.6A
d. Prestressing Technique.		X			Art. 3.6B
e. Grade & size of prestressing tendons and anchorage.		X			Art. 2.4B, 2.4H
2. The inspection program shall verify					
a. Size and location of structural elements.		X			3.3G
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.		X		Sec. 1.2.2(e), 2.1.4, 3.1.6	
c. Specified size, grade and type of reinforcement.		X		Sec. 1.12	Art. 2.4, 3.4
d. Welding of reinforcing bars.	X		Sec. 2108.9.2.11 Item 2	Sec. 2.1.10.6.2, 3.2.3.4.(b)	
e. Protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature over 90°F).		X	Sec. 2104.3, 2104.4		Art. 1.8C, 1.8D
f. Application & measurement of prestressing force.		X			Art. 3.6B
3. Prior to grouting, the following shall be verified to ensure compliance:					
a. Grout space is clean.		X			Art. 3.2D
b. Placement of reinforcement and connectors.	—	X	—	Sec. 1.12	Art. 3.4
c. Proportions of site-prepared grout.		X			Art. 2.6B
d. Construction of mortar joints.		X			Art. 3.3B
4. Grout placement shall be verified to ensure compliance with code and construction document provisions.	X	—	—	—	Art. 3.5
a. Grouting of prestressing bonded tendons.	X				Art. 3.6C
5. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.	X	—	Sec. 2105.2.2, 2105.3	—	Art. 1.4
6. Compliance w/ required inspection provisions of construction documents & the approved submittals are verified.	—	X	—	—	Art. 1.5

For SI: °C = (°F - 32)/1.8.

a. The specific standards referenced are those listed in Chapter 35.

**NCSBC-TABLE 1704.5.3  
LEVEL 2 SPECIAL INSPECTION**

INSPECTION TASK	FREQUENCY OF INSPECTION		REFERENCE FOR CRITERIA		
	Continuous during task listed	Periodically during task listed	NCSBC section	ACI 530/ ASCE 5/ TMS 402 <sup>a</sup>	ACI 530.1/ ASCE 6/ TMS 602 <sup>a</sup>
1. From the beginning of masonry construction, the following shall be verified to ensure compliance:					
a. Proportions of site-mixed mortar and grout.		X			Art. 2.6A
b. Placement of masonry units and construction of mortar joints.		X	—		Art. 3.3B
c. Placement of reinforcement and connectors.		X		Sec. 1.12	Art. 3.4, 3.6
d. Grout space prior to grouting.	X				Art. 3.2D
e. Placement of grout.	X				Art. 3.5
f. Placing of Prestressing grout.	X				Art. 3.6C
2. Inspection program shall verify:					
a. Size and location of structural elements.		X			3.3G
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	X			Sec. .2.2(e), 2.1.4, 3.1.6	
c. Specified size, grade and type of reinforcement.		X		Sec. 1.12	Art. 2.4, 3.4
d. Welding of reinforcing bars.	X			Sec. 2.1.10.6.2, 3.2.3.4(b)	
e. Protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F).		X	Sec. 2104.3, 2104.4		Art. 1.8C, 1.8D
f. Application & measurement of prestressing force.	X				Art. 3.6B
3. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.	X	—	Sec. 2105.2.2, 2105.3	—	Art. 1.4
4. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.	—	X	—	—	Art. 1.5

For SI: °C = (°F - 32)/1.8.

a. The specific standards referenced are those listed in Chapter 35.

**SICC-904 COLD-WEATHER AND HOT-WEATHER CONSTRUCTION**

**SICC-904.1 Cold weather.** When either the ambient temperature falls below 40°F (4°C), or the temperature of masonry units is below 40°F (4°C), cold weather construction requirements as specified in NCSBC-Table 1704.5.1 or NCSBC-Table 1704.5.3 and NCSBC-2104.3 shall be implemented.

**NCSBC-2104.3 Cold-weather construction.** The cold-weather construction provisions of ACI 530.1/ASCE6/TMS 602, Article 1.8C, or the following procedures shall be implemented when either the ambient temperature falls below 40°F (4°C) or the temperature of masonry units is below 40°F (4°C).

**NCSBC-2104.3.1 Preparation.**

1. Temperatures of masonry units shall not be less than 20°F (-7°C) when laid in the masonry. Masonry units containing frozen moisture, visible ice or snow on their surface shall not be laid.
2. Visible ice and snow shall be removed from the top surface of existing foundations and masonry to receive new construction. These surfaces shall be heated to above freezing, using methods that do not result in damage.

**NCSBC-2104.3.2 Construction.** The following requirements shall apply to work in progress and shall be based on ambient temperature.

**NCSBC-2104.3.2.1 Construction requirements for temperatures between 40 °F and 32 °F.** The following construction requirements shall be met when the ambient temperature is between 40 °F and 32 °F:

1. Glass unit masonry shall not be laid.
2. Water and aggregates, used in mortar and grout shall not be heated above 140 °F.
3. Mortar sand or mixing water shall be heated to produce mortar temperatures between 40 °F and 120°F at time of mixing. When water and aggregates for grout are below 32 °F, they shall be heated.

**NCSBC-2104.3.2.2 Construction requirements for temperatures between 32 °F and 25 °F.** The requirements of Sections 2104.3.2.1 and the following construction requirements shall be met when the ambient temperature is between 32 °F and 25 °F:

1. The mortar temperature shall be maintained above freezing until used in masonry.
2. Aggregates and mixing water for grout shall be heated to produce grout temperature between 70 °F and 120 °F at the time of mixing. Grout temperature shall be maintained above 70 °F at the time of grout placement.

**NCSBC-2104.3.2.3 Construction requirements for temperatures between 25°F (-4°C) and 20°F (-7°C).** The requirements of Sections 2104.3.2.1 and 2104.3.2.2 and the following construction requirements shall be met when the ambient temperature is between 25°F (-4°C) and 20°F (-7°C):

1. Masonry surfaces under construction shall be heated to 40°F (4°C).
2. Wind breaks or enclosures shall be provided when the wind velocity exceeds 15 miles per hour (mph) (24 km/h).
3. Prior to grouting, masonry shall be heated to a minimum of 40°F (4°C).

**NCSBC-2104.3.2.4. Construction requirements for temperatures below 20°F (-7°C).** The requirements of Sections 2104.3.2.1, 2104.3.2.2 and 2104.3.2.3 and the following construction requirement shall be met when the ambient temperature is below 20°F (-7°C): Enclosures and auxiliary heat shall be provided to maintain air temperature within the enclosure to above 32°F (0°C).

**NCSBC-2104.3.3 Protection.** The requirements of this section and Sections 2104.3.3.1 through 2104.3.3.4 apply after the masonry is placed and shall be based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry.

**NCSBC-2104.3.3.1 Glass unit masonry.** The temperature of glass unit masonry shall be maintained above 40°F (4°C) for 48 hours after construction.

**NCSBC-2104.3.3.2 Protection requirements for temperatures between 40°F (4°C) and 25°F (-4°C).** When the temperature is between 40°F (4°C) and 25°F (-4°C), newly constructed masonry shall be covered with a weather-resistive membrane for 24 hours after being completed.

**NCSBC-2104.3.3.3 Protection requirements for temperatures between 25°F(-4°C) and 20°F(-7°C).** When the temperature is between 25°F (-4°C) and 20°F (-7°C), newly constructed masonry shall be completely covered with weather-resistive insulating blankets, or equal protection, for 24 hours after being completed. The time period shall be extended to 48 hours for grouted masonry, unless the only cement in the grout is Type III portland cement.

**NCSBC-2104.3.3.4 Protection requirements for temperatures below 20°F (-7°C).** When the temperature is below 20°F (-7°C), newly constructed masonry shall be maintained at a temperature above 32°F (0°C) for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. The time period shall be extended to 48

hours for grouted masonry, unless the only cement in the grout is Type III portland cement.

**SICC-904.2 Hot weather.** When either the ambient temperature equals or exceeds 100 °F (38°C), or the ambient temperature equals or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h), hot weather construction requirements as specified in NCSBC-Table 1704.5.1 or NCSBC-Table 1704.5.3 and NCSBC-2104.4 shall be implemented.

**NCSBC-2104.4 Hot weather construction.** The hot weather construction provisions of ACI 530.1/ASCE6/TMS 602, Article 1.8D, or the following hot-weather procedures shall be implemented when the temperature or the temperature and wind-velocity limits of this section are exceeded.

**NCSBC-2104.4.1 Preparation.** The following requirements shall be met prior to conducting masonry work.

**NCSBC-2104.4.1.1. Temperature.** When the ambient temperature exceeds 100 °F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h):

1. Necessary conditions and equipment shall be provided to produce mortar having a temperature below 120°F (49°C).
2. Sand piles shall be maintained in a damp, loose condition.

**NCSBC-2104.4.1.2. Special conditions.** When the ambient temperature exceeds 115°F (46°C), or 105°F with a wind velocity greater than 8 mph, the requirements of Section 2104.4.1.1 shall be implemented and materials and mixing equipment shall be shaded from direct sunlight.

**NCSBC-2104.4.2 Construction.** The following requirements shall be met while masonry work is in progress.

**NCSBC-2104.4.2.1. Temperature.** When the ambient temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h):

1. The temperature of mortar and grout shall be maintained below 120°F (49°C).
2. Mixers, mortar transport containers and mortar boards shall be flushed with cool water before they come into contact with mortar ingredients or mortar.
3. Mortar consistency shall be maintained by retempering with cool water.
4. Mortar shall be used within 2 hours of initial mixing.

**NCSBC-2104.4.2.2. Special conditions.** When the ambient temperature exceeds 115°F (46°C), or exceeds 105°F (40°C) with a wind velocity greater than 8 mph (13 km/h), the requirements of Section 2104.4.2.1 shall be implemented and cool mixing water shall be used for mortar and grout. The use of ice shall be permitted in the mixing water prior to use. Ice shall not be permitted in the mixing water when added to the other mortar or grout materials.

**NCSBC-2104.4.3 Protection.** When the mean daily temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h), newly constructed masonry shall be fog sprayed until damp at least three times a day until the masonry is three days old.

**SICC-904.3 Temperature records.** The **SIER** shall maintain and submit temperature records with daily inspection reports.

## **SICC-905 STRUCTURAL TESTING FOR SEISMIC RESISTANCE OF MASONRY CONSTRUCTION**

### **SECTION 1708**

**1708.1 Masonry.** Testing and verification of masonry materials and assemblies prior to construction shall

comply with the requirements of this section, depending on the classification of building or structure or nature of occupancy, as defined in this code (see Table 1604.5 or Section 1616.2).

**1708.1.1 Empirically designed masonry and glass unit masonry in nonessential facilities.**

For masonry designed by Section 2109 or 2110, or by Chapter 5 or 7 of ACI 530/ASCE 5/TMS 402, in nonessential facilities (see Table 1604.5 or Section 1616.2), certificates of compliance used in masonry construction shall be verified prior to construction.

**1708.1.2 Empirically designed masonry and glass unit masonry in essential facilities.**

The minimum testing and verification prior to construction for masonry designed by Section 2109 or 2110, or by Chapter 5 or 7 of ACI 530/ASCE 5/TMS 402, in essential facilities (see Table 1604.5 or Section 1616.2) shall comply with the requirements of Table 1708.1.2, Level 1 Quality Assurance.

**1708.1.3 Engineered masonry in nonessential facilities.**

The minimum testing and verification prior to construction for masonry designed by Section 2107 or 2108, or by chapters other than Chapter 5, 6 or 7 of ACI 530/ASCE 5/TMS 402, in nonessential facilities (see Table 1604.5 or Section 1616.2) shall comply with Table 1708.1.2, Level 1 Quality Assurance.

**1708.1.4 Engineered masonry in essential facilities.**

The minimum testing and verification prior to construction for masonry designed by Section 2107 or 2108, or by chapters other than Chapter 5, 6 or 7 of ACI 530/ASCE 5/TMS 402, in essential facilities (see Table 1604.5 or Section 1616.2) shall comply with Table 1708.1.4, Level 2 Quality Assurance.

**TABLE 1708.1.2  
LEVEL 1 QUALITY ASSURANCE**

<b>MINIMUM TESTS AND SUBMITTALS</b>
Certificates of compliance used in masonry construction.
Verifications of $f'_m$ prior to construction, except where specifically exempted by the NC building code.

**TABLE 1708.1.4 LEVEL 2  
QUALITY ASSURANCE**

<b>MINIMUM TESTS AND SUBMITTALS</b>
Certificates of compliance used in masonry construction.
Verifications of $f'_m$ prior to construction and every 5000 square feet during construction.
Verification of proportions of materials in mortar and grout as delivered to the site.

**SICC-906 COMPLETION OF MASONRY CONSTRUCTION**

Upon completion of masonry special inspections, 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 all masonry construction.

## Masonry (CASE Guidelines)

Item	Scope
1. Material Certification	
2. Mixing of Mortar and Grout	<i>Inspect proportioning, mixing and retempering of mortar and grout.</i>
3. Installation of Masonry	<i>Inspect size, layout, bonding and placement of masonry units.</i>
4. Mortar Joints	<i>Inspect construction of mortar joints including tooling and filling of head joints.</i>
5. Reinforcement Installation	<i>Inspect placement, positioning and lapping of reinforcing steel.</i> <i>Inspect welding of reinforcing steel.</i>
6. Prestressed Masonry	<i>Inspect placement, anchorage and stressing of prestressing bars.</i>
7. Grouting Operations	<i>Inspect placement and consolidation of grout. Inspect masonry clean-outs for high-lift grouting.</i>
7. Weather Protection	<i>Inspect cold weather protection and hot weather protection procedures. Verify that wall cavities are protected against precipitation.</i>
9. Evaluation of Masonry Strength	<i>Test compressive strength of mortar and grout cube samples (ASTM C780).</i> <i>Test compressive strength of masonry prisms (ASTM C1314).</i>
10. Anchors and Ties	<i>Inspect size, location, spacing and embedment of dowels, anchors and ties.</i>
11. Other:	