

## SECTION 042200 - STRUCTURAL CONCRETE MASONRY

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Section includes structural concrete masonry shown on the Structural Drawings.

#### 1.2 RELATED SECTIONS

- A. Section 013330 - Structural Submittals.
- B. Section 014525 - Structural Testing/Inspection Agency Services.
- C. Section 032000 - Concrete Reinforcement.
- D. Section 033000 - Cast-in-Place Concrete.
- E. Section 042000 - Unit Masonry.

#### 1.3 REFERENCES

- A. TMS 602 - Specification for Masonry Structures.
- B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- D. ASTM C90 - Standard Specification for Load-Bearing Concrete Units.
- E. ASTM C91 - Standard Specification for Masonry Cement
- F. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
- G. ASTM C140 - Standard Methods of Sampling and Testing Concrete Masonry Units.
- H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- K. ASTM C476 - Standard Specification for Grout for Masonry.
- L. ASTM C1019 - Standard Method of Sampling and Testing Grout.

- M. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
- N. ASTM E447 - Standard Test Methods for Compressive Strength of Masonry Prisms.
- O. TMS 402 – Building Code for Masonry Structures.

#### 1.4 SUBMITTALS

- A. Submit material certificates signed by the material supplier for the following:
  - 1. Masonry unit material properties and test reports showing compliance with requirements. Include data and calculations establishing average net-area compressive strength of units.
  - 2. Integral water repellant used in CMUs.
  - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 4. Mortar admixtures.
  - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 6. Grout mixes. Include description of type and proportions of ingredients.
  - 7. Reinforcing bars.
  - 8. Joint reinforcement.
  - 9. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109 for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
  - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Submit shop drawings for masonry reinforcement in accordance with Section 032000.
- D. Submit procedures for construction of masonry walls to be filled with coarse grout. Procedures should include high lift or low lift grouting as applicable to project.
- E. Manufacturer's Qualifications: Manufacturer shall have on file current certified test reports defined as those reports performed and dated within twelve months of the bid due date of the project. Manufacturer shall certify that the masonry units supplied for the project shall be a minimum of 30 days old at time of shipment from manufacturer and shall be sole sourced from one plant.
- F. Installer Qualifications: Certify a minimum of 2 years experience with similar masonry installations.

#### 1.5 QUALITY ASSURANCE

- A. Structural Testing/Inspection Agency shall perform the following quality related items:

1. Verify reinforcing steel for quantity, size, and location.
  2. Verify manufacturer's and installer's qualifications.
  3. Verify placement of coarse grout as indicated in high or low lift procedure.
  4. Verify compressive strength of concrete masonry units, mortar, coarse grout, or masonry prisms for each 5,000 sq. ft. of surface area as follows:
    - a. Three (3) concrete masonry units shall be tested in accordance with ASTM C140.
    - b. Six (6) mortar cube specimens shall be tested, three (3) at 7-days and three (3) at 28-days, in accordance with ASTM C109.
    - c. Four (4) coarse grout specimens shall be tested, two (2) at 7-days and two (2) at 28-days, in accordance with ASTM C1019.
    - d. In lieu of individual tests of masonry units, mortar, and grout, if directed by the Design Professional, perform one (1) prism test (which consists of three prisms) in accordance with ASTM E447.
- B. The Structural Testing / Inspection Agency shall provide special inspections as required by Chapter 17 of the building code as required by Specification 01 4525.

## 1.6 HANDLING OF MATERIALS

- A. Package, handle, and store materials to protect from elements and prevent contamination.

## PART 2 - PRODUCTS

### 2.1 CONCRETE MASONRY

- A. Concrete masonry shall have the minimum compressive strength (f'm) specified on the Drawings. Concrete masonry shall have a minimum density of 105 pcf.

### 2.2 CONCRETE MASONRY UNITS

- A. Concrete masonry units shall conform to ASTM C90.
- B. Provide lightweight concrete masonry units.
- C. Concrete masonry units shall have, as a minimum, the net area compressive strength listed in Table 1 of TMS 602 required for the specified f'm.
- D. Provide standard units with face dimensions of 16" long x 8" high nominal, unless indicated otherwise.
- E. Provide special shapes where indicated on the Drawings.

### 2.3 MORTAR

- A. Mortar shall be Type M or Type S Masonry cement in accordance with ASTM C270. Refer to Drawings for locations. For SDC D or greater, replace masonry cement with

Portland Cement or Mortar Cement. Aggregate for Masonry Mortar shall be in accordance with ASTM C144.

- B. Do not use admixtures that contain chlorides.

## 2.4 COARSE GROUT

- A. Coarse grout shall conform to ASTM C1064.
- B. Coarse grout shall have the minimum compressive strength specified on the Drawings.
- C. Mix grout to a consistency which has a slump between 8 and 10 inches.
- D. Do not use admixtures that contain chlorides.

## 2.5 WATER

- A. Provide clean potable water free of deleterious substances.

## 2.6 REINFORCEMENT

- A. Horizontal and vertical reinforcing bars shall comply with Section 032000.

## 2.7 HORIZONTAL JOINT REINFORCEMENT

- A. Horizontal joint reinforcement shall be manufactured with longitudinal parallel, deformed side wires in accordance with ASTM A951 and of the size specified on the Drawings. Cross wires shall be No. 9 gauge spaced not more than 16" on center.
- B. Provide as a minimum, one side wire for each face shell of hollow masonry units. Provide additional side wires or eye sections for adjustable wall ties as specified for multiwythe wall construction.
- C. Provide ladder type reinforcement.
- D. Horizontal joint reinforcement shall be hot-dipped galvanized in accordance with ASTM A153, Class B-2.
- E. Provide in lengths of not less than 10 feet. Provide prefabricated corner and tee shape corner accessories.

## 2.8 CONTRACTION JOINT MATERIAL

- A. Contraction joint material shall comply with ASTM D2000, M2AA-805 with rubber shear keys with a minimum durometer hardness of 80.

# PART 3 - EXECUTION

## 3.1 MIXING

- A. Except as otherwise approved for small batches, mix in mechanically operated batch mixers of drum type in which water can be accurately and uniformly controlled. Allow five minutes maximum mixing time, two minutes for dry mixing and three minutes for continued mixing after water has been added. Do not permit volume of batch to exceed manufacturer's rated capacity of mixer drum. Empty drum completely before placing next batch. Keep mixers and wheelbarrows clean. Do not deposit mortar upon or permit contact with ground.
- B. Do not use anti-freeze compounds.

### 3.2 CONSTRUCTION

- A. Use dry masonry units. No frozen or wet units shall be used.
- B. Discard cracked, chipped, and spalled masonry units.
- C. Deliver mortar to mason's board at point of use within 45 minutes after mixing. Do no retempering. Use no admixtures. Use pre-hydrated mortar for tuck points. Prepare pointing mortar with as dry consistency as will produce mortar sufficiently plastic to be worked into joints.
- D. During erection cover top of wall with strong waterproof membrane at end of each day when shutdown. Cover partially completed walls when work is not in progress. Extend and secure cover a minimum of 24 in. down both sides. Do not apply uniform floor or roof loading for at least 12 hours after building masonry columns or walls. Do not apply concentrated loads for at least 3 days after building masonry columns or walls.
- E. Provide temporary bracing during erection as required to stabilize erected masonry.
- F. Except where otherwise indicated, lay block in running bond.

### 3.3 PLACING AND BONDING

- A. Lay masonry in full beds of mortar on mating surfaces, and properly jointed with other work. Buttering corners of joints, deep or excess furrowing of mortar joints is not permitted.
- B. Fully bond external corners of concrete block. Where interior block partitions intersect other block walls or partitions, provide control joints with mortar raked back 1/4 inch.
- C. Isolate masonry partitions from vertical structural framing members with control joints, with mortar raked back 1/4 inch.
- D. Where non-bearing masonry partitions extend to underside of floor, roof deck or structural system, stop masonry short 3/8 to 1/2 inch to allow for live load deflection. Fill gap with soft joint filler.
- E. Where masonry chase walls are constructed, one wall can be stopped above ceiling to provide access space.

### 3.4 CONTRACTION JOINTS

- A. Install contraction joints at locations indicated on the Drawings in all masonry walls. Do not run masonry reinforcement through contraction joints.

### 3.5 TOLERANCES

- A. Variation from Unit to Adjacent Unit: 1/32 inch maximum.
- B. Variation from Plan of Wall: Maximum 1/4 inch in 10 feet, and 1/2 inch in 20 feet or more.
- C. Variation from Plumb: +/- 1/4 inch in 10 feet, +/- 3/8 inch in 20 feet; +/- 1/2 inch maximum.
- D. Variation in Level Coursing: +/- 1/4 inch in 10 feet; +/- 1/2 inch maximum.
- E. Variation in Joint Thickness: +/- 1/8 inch Maximum.

### 3.6 HORIZONTAL JOINT REINFORCEMENT

- A. Place horizontal joint reinforcement in the horizontal mortar beds at spacings as noted in the Drawings, except as specified herein.
- B. For masonry below grade, space horizontal joint reinforcing at 8 inches vertically.
- C. Above lintels and below sills at openings, place a continuous run of horizontal joint reinforcement in the first two bed joints, 8 inches apart. Extend joint reinforcement two feet beyond opening.
- D. Joint reinforcement shall be continuous, except it shall not pass through vertical masonry contraction joints. Lap joint reinforcement a minimum of 6 inches.

### 3.7 ENVIRONMENTAL PROVISIONS

- A. Cold weather masonry construction shall comply with TMS 602-16 per the following:
  - 1. When ambient temperature is below 40 degrees F, implement cold weather procedures per the following:
    - a. Do not lay masonry units having either a temperature below 20 degrees F or containing frozen moisture, visible ice or snow on their surface.
    - b. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction and heat these surfaces above freezing using methods that do not result in damage.
    - c. Do not heat water or aggregates used in mortar or grout above 140 degrees F. Comply with the following:
      - 1) Between 40 degrees F and 32 degrees F -

- i. Heat sand or mixing water to produce mortar temperature between 40 degrees F and 120 degrees F at time of mixing.
  - ii. Heat grout materials when the temperature of the materials is below 32 degrees F.
- 2) Between 32 degrees F and 25 degrees F –
  - i. Heat sand or mixing water to produce mortar temperature between 40 degrees F and 120 degrees F at time of mixing.
  - ii. Heat grout materials and mixing water to produce grout temperature between 70 degree F and 120 degree F at the time of mixing. Maintain grout temperature above 70 degree F at the time of grout placement.
- 3) Between 25 degrees F and 20 degrees F –
  - i. Heat sand or mixing water to produce mortar temperature between 40 degrees F and 120 degrees F at time of mixing. Maintain mortar temperature above freezing until used in masonry.
  - ii. Heat masonry surfaces under construction to a minimum temperature of 40 degrees F.
  - iii. Heat grout aggregates and mixing water to produce grout temperature between 70 degree F and 120 degree F at the time of mixing. Maintain grout temperature above 70 degree F at the time of grout placement.
  - iv. Use wind breaks or enclosures when the wind velocity is greater than 15 mph.
  - v. Heat masonry to 40 degrees F prior to grouting.
- 4) Below 20 degrees F –
  - i. Comply with previous requirements and provide an enclosure and auxiliary heat to maintain air temperature above 32 degrees F within the enclosure.
- 2. When ambient temperature is between 25 degrees F and 40 degrees F, cover newly constructed masonry completely with weather-resistive blankets or equal protection for 24 hours after completion of work. Extend time period to 48 hours for grouted masonry.
- 3. Below 25 degrees F, maintain newly constructed masonry temperature above 32 degrees F for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. Extend time period to 48 hours for grouted masonry.

B. Hot weather masonry construction shall comply with TMS 602-16 per the following:

1. When ambient temperature exceeds 100 degrees F or exceeds 90 degrees F with a wind velocity greater than 8mph:
  - a. Maintain sand piles in a damp, loose condition.
  - b. Provide necessary conditions and equipment to produce mortar having a temperature below 120 degrees F.
  - c. Maintain temperature of mortar and grout below 120 degrees F.
  - d. Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar ingredients or mortar.
  - e. Maintain mortar consistency by retempering with cool water.
  - f. Use mortar within 2 hours of initial mixing.
  - g. Fog spray newly constructed masonry until damp, at least 3 times a day until the masonry is three days old.
2. When ambient temperature exceeds 115 degrees F or exceeds 105 degrees F with a wind velocity greater than 8mph follow requirements in section 3.8.B.1 and the following additional requirements:
  - a. Shade materials and mixing equipment from direct sunlight.
  - b. Use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Do not permit ice in the mixing water when added to other mortar or grout materials.

### 3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special Inspections according to the specification 014525 and TMS 402.
  1. Begin masonry construction only after inspectors have verified proportions of site prepared mortar.
  2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes and locations of reinforcement.
  3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing: Test according to Section 1.5 – Quality Assurance.

### 3.9 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.



- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

END OF SECTION 042200