

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire or plastic, and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
  2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Type used shall not perforate vapor retarder.
  3. For slabs on metal deck, use bright basic (CRSI, Class 3) continuous mesh support or reinforcing bar chairs for type of reinforcing required.

## 2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
- B. Fly Ash: ASTM C 618, Class F.
- C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
1. Fine Aggregate: Sand shall consist of hard, tough and preferably siliceous material, clean, free from mineral or other coatings, soft particles, clay, loam or other deleterious matter.
  2. Coarse Aggregate: Crushed stone or gravel, having clean, hard, durable, uncoated particles, free from deleterious matter. The 1-1/2" (38 mm) aggregate shall conform to gradation #467 and the 3/4" (19 mm) aggregate to size #67 in Table II of ASTM C-33. 3/4" (19 mm) aggregate shall be the minimum permissible size used, unless required for structural clearances between reinforcing bars or between bars and the forms require smaller aggregate size. Clearances requiring smaller aggregate size shall be submitted to the Engineer for verification and approval.

- D. Water: Potable and complying with ASTM C 94.

## 2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Mid-Range, Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F or G.
- E. Accelerating Admixture: ASTM C 494, Type C.
- F. Retarding Admixture: ASTM C 494, Type D.

## 2.6 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Ribbed with center bulb.
2. Available Products: Subject to compliance with requirements, provide products by one of the following:
  - a. 723; Greenstreak Plastic Products Co.
  - b. No. 6180-ND; W.R. Meadows, Inc.
  - c. RSB6-38; Vynylex Corp.

- B. Expandable Waterstops: Manufactured strip, 1" x 3/4" (25 x 19 mm), sodium bentonite or other hydrophylic material for adhesive bonding to concrete.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Superstop; Mameco/Paramount
    - b. Water Stop RX; Volclay Waterproofing Systems
    - c. SwellStop; Greenstreak

## 2.7 FLOOR AND SLAB TREATMENTS

- A. Exterior Sealer: Provide one of the following products:
1. ProSoCo, Inc.: Consolidex Saltguard WB.
  2. Sika: Sikagard 70.
- B. Interior Sealer: Ashford Formula manufactured by Curecrete Chemical Company.

## 2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Eucobar; Euclid Chemical Co.
    - b. E-Con; L&M Construction Chemicals, Inc.
    - c. Confilm; Master Builders, Inc.
    - d. Finisher's Friend; Jay Kay Sales.
- B. Moisture-Retaining Cover:
1. Waterproof paper, complying with ASTM C 171.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aqua-Cure Vox, Euclid Chemical Co.
    - b. Dress & Seal WB, L&M Construction Chemicals, Inc.
    - c. Masterkure 100W, Master Builders, Inc.

## 2.9 RELATED MATERIALS

- A. Joint-Filler Strips:
1. ASTM D 1751, asphalt-saturated cellulosic fiber.

2. 2 pound minimum density closed cell polyethylene with 3/8" (9 mm) deep top strip off to allow installation of joint sealant; 3/8 inch (9 mm) thickness by full depth of slab; Isostrip by Jay Kay Sales, or approved equal.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

1. Available Products:

- a. Day-Chem Ad Bond, Dayton Superior Corp.
- b. SBR Latex, Euclid Chemical Co.
- c. Daraweld C, W.R. Grace & Co.
- d. Hornweld, A.C. Horn, Inc.
- e. Everbond, L&M Construction Chemicals, Inc.
- f. Acryl-Set, Master Builders Inc.

C. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Euco Epoxy System #452 or #620, Euclid Chemical Co.
2. Epoxitite Binder 2390, A.C. Horn, Inc.
3. Epobond, L&M Construction Chemicals, Inc.
4. Congresive Standard Liquid, Master Builders, Inc.
5. Sikadur 32 Hi-Mod, Sika Corp.

D. Non-Shrink Grout: "Euco N-S" by the Euclid Chemical Company; "Master-Flow 928" (non-metallic) by Master Builders, Five Star Grout, Dayton Superior Sure Grip Grout, or Sika Grout 212. The grout shall conform to CRD C-621, type b or d.

## 2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
2. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
3. Available Products:
  - a. K-15 with P-51 primer, Ardex, Inc.
  - b. Levelex with Levelex Primer, L&M Construction Chemicals, Inc.
  - c. Silflo 200 with Silflo Primer; Silpro Masonry Systems, Inc.
  - d. Thoro Underlayment Self-Leveling with Thoro Primer 800; Thoro System Products.

## 2.11 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, according to ACI 211.1 and ACI 301.

B. Concrete Slabs: 4000-psi concrete for interior concrete slabs shall not be less than 3600-psi and not more than 4400-psi in 28 days. It is the intent of this requirement to lower the cement content to reduce concrete shrinkage for slabs.

- C. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.
- D. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
  2. Water-Cement Ratio: 0.40 maximum (air-entrained).
- E. Interior Slab-on-Grade: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
  2. Water-Cement Ratio: 0.35 maximum (non-air-entrained).
- F. Suspended Slabs: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
  2. Water-Cement Ratio: 0.35 maximum (non-air-entrained).
- G. Exterior Slabs, Pads, Steps, and Pole Bases: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
  2. Water-Cement Ratio: 0.40 maximum, air-entrained.
- H. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramps and sloping surfaces: Not more than 3 inches (75 mm).
  2. Slabs: Not more than 4.5 inches (113 mm).
  3. Reinforced foundation systems: Not less than 2 inch (50 mm) and not more than 5 inches (125 mm).
  4. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-5-inch (50-to-125 mm) slump concrete. Plant-added high-range water-reducing admixture is subject to approval by Engineer. Use of high-range water-reducing admixture is prohibited for slabs.
  5. Other concrete: Not more than 4 inches(100 mm).
- I. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.
- J. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 0.5 percent, unless otherwise indicated:
1. Air Content: 5.5 percent for 1-1/2-inch- (38-mm-) nominal maximum aggregate size.
  2. Air Content: 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.
- K. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- L. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- M. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use mid-range water-reducing admixture for all concrete. Add admixture at manufacturer's prescribed rate.

2. Accelerating admixture may be used in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
3. Retarding admixture may be used in concrete slabs placed at ambient temperatures above 80 deg F (27 deg C).
4. High-range water-reducing admixture may be used for reinforced foundation systems. High-range water-reducing admixture is not permitted for use in slabs.

## 2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
  1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. When air temperature has fallen to or is expected to fall between 40 deg F (4 deg C) and 30 deg F (-1 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 60 deg F (16 deg C) and not more than 80 deg F (27 deg C) at point of placement. When air temperature has fallen to or is expected to fall below 30 deg F (-1 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 65 deg F (18 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  1. Do not use frozen materials or materials containing ice or snow.
  2. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
- C. When Hot Weather Conditions Cause Concrete Temperatures to Exceed 90 deg F (32 deg C) Perform the Following Procedures:
  1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Use retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

- C. Limit concrete surface irregularities, designated by ACI 347 limits and as follows:
1. Surfaces exposed to view: Class A tolerance, checked with 5 foot template, except gradual irregularities not to exceed 1/4 inch (6 mm) and abrupt surface irregularities not to exceed 1/8 inch (3 mm).
  2. Other concrete surfaces: Provide Class C tolerances checked with 5 foot (1525 mm) template, with gradual irregularities not to exceed 1/2 inch (12 mm) and abrupt surface irregularities not to exceed 1/4 inch (6 mm).
  3. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (12 mm in 6 m), nor 3/4 inch in 40 feet (19 mm in 12 m) or more.
  4. Variation of Cross-Sectional Dimension (thickness): 12 inch (305 mm) dimension or less, do not exceed 3/8 inch (10 mm) greater nor 1/4 inch (6 mm) less than indicated. 12 inch (305 mm) dimension but not over 3 foot (915 mm) dimension, do not exceed 1/2 inch (12 mm) greater nor 3/8 inch (10 mm) less than indicated.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exposed corners and edges of 3/4" unless otherwise noted, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Install dovetail anchor slots in concrete structures as indicated on drawings.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor bolts, accurately located, to elevations required.
  2. Install dovetail anchor slots in concrete structures as indicated.

- B. No aluminum conduit, pipe, inserts, reglets, etc. shall be placed in any concrete unless it is coated with bituminous dampproofing.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.
2. At least 70 percent of 28-day design compressive strength.
3. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
4. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

### 3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

### 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire. Support welded wire fabric with continuous mesh supports, spaced to hold welded wire fabric in proper position.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
  1. Sawed Joints: Saw control joints, 1 inch (25 mm) deep with Sof-Cut Model 280 saw, immediately after final troweling with cutting completed within 2 hours after final pass of trowel. Vacuum saw cut concrete spoils from floor surface immediately behind the saw cutting operations.
  2. Contraction joints shall be placed in accordance with approved Shop Drawings, with a maximum panel area as specified below. The panel shall be as nearly square as possible. Conform to bay spacing wherever possible (at column centerlines, half bays, third bays, one quarter bays, etc.).
  3. Saw cut non-reinforced slabs on grade in accordance with the following maximum spacing, unless noted otherwise;
    - a. 4 inch thick: 8 feet
    - b. 5 to 6 inches thick: 10 feet.
    - c. 6 1/4 to 7 inches thick: 12 feet.
    - d. 7 1/4 to 8 inches thick: 14 feet.



- D. Joints in Sidewalks and Exterior Flatwork: Groove control joints in concrete to detailed layout. Groover tool shall be Goldblatt Trowel No. 84389 06125 or equal, with 1 inch (25 mm) deep groove and 1/4 inch (6 mm) radius edge. Radius edges of walk with 1/4 inch (6 mm) radius edge tool.
1. Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
    - a. At exposed interior slabs (not covered by floor covering), after concrete of adjacent pour has hardened, saw cut along construction joint for installation of joint sealant.
  - E. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
    1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
    2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
    3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 WATERSTOPS

- A. PVC Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions. Allow proper clearances and properly secure to prevent displacement. Thoroughly and systematically vibrate concrete around waterstop to obtain impervious, void-free concrete in vicinity of joint and to maximize intimate contact between concrete and waterstop.
- B. Expandable Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.
1. Clean surfaces where Waterstop is to be applied, free of excessive dust, debris and water. Irregular and honeycombed surfaces shall be made reasonably smooth.
  2. Apply Waterstop in a continuous strip on the water side of steel. Apply strip at ten foot intervals running perpendicular to the first bead [full depth of slab].

- 3.8 Provide 6 mil. polyethylene plastic underslab moisture vapor barrier under all slabs on grade. Place vapor barrier between 2" dry sand and controlled structural fill.

### 3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section **CANNOT** be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
  2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats and highway straightedge to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
  3. Slope surfaces uniformly to drains where required.
  4. Maintain reinforcing in proper position on chairs during concrete placement.
- F. Placing Exterior Concrete Walks and Flatwork: Place concrete, screed and wood float surfaces to a smooth and uniform finish, free of open texturing and exposed aggregate. Avoid working mortar to surface.
1. Bull float directly behind screed before bleedwater appears.
  2. Immediately behind bullfloat, drag broom across surface for a medium broom finish. If bleedwater appears before application of broom finish, allow surface water to evaporate before brooming.
- G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305K and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control

temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.10 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
  1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
  2. Do not apply rubbed finish to smooth-formed finish.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraining, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraining until surface is left with a uniform, smooth, granular texture.
  1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restrain until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
  2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 20; and levelness, F(L) 17.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

### 3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.
- E. Non-Shrink Grout: Grout steel billet bearing plates, column base plates, equipment bases, and other locations noted in the Structural Drawings with non-shrink grout.

### 3.13 CONCRETE PROTECTION, SEALERS AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by the following method:
  - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- D. Interior Slab Surfaces: Begin curing immediately after finishing concrete. Cure floors and slabs, concrete floor toppings, and other surfaces, by the following method:
  - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - 2. Apply curing compound to concrete slabs as soon as final finishing operations and saw cutting are complete.
  - 3. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

- E. Exterior Slab Surfaces: Begin curing immediately after finishing concrete. Cure exterior slabs by the following method:
1. Curing Compound: Apply curing compound to exterior concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
- F. Exterior Sealer: Apply to all exterior concrete flatwork including stairs, ramps and sidewalks in accordance with manufacturer's instructions. Allow concrete to cure 28 days minimum. Coat clean, dry exterior slabs with water repellent sealer at the rate recommended by the manufacturer. Concrete surface temperature shall be between 50deg and 100deg F (10 and 38deg C).
- G. Interior Sealer: Allow concrete to cure 28 days minimum. Apply sealer compound to interior concrete floors left exposed and sealed. Allow concrete to cure 4 days minimum after removal of curing method. Apply sealer compound to interior concrete floors left exposed and sealed before dirtied by construction operations.
1. Surface shall be dry and clean, free of dirt, dust, and stains. Clean and dry slab that has become dirty using mechanical scrubbers with squeegee wetvac attachment.
  2. Spray the product with a low pressure sprayer to the entire surface as soon as the surface is firm enough to walk on.
  3. Keep the entire surface wet for 30 minutes by brooming excess product onto the dry spots or re-spraying the dry spots immediately.
  4. As the product begins to dry into the surface and becomes slippery underfoot, lightly sprinkle the surface with water to aid penetration and to bring alkali to the surface.
  5. As the product again begins to dry into the surface and becomes slippery underfoot, flush the surface with water and squeegee the surface totally dry, removing all excess product and alkali or other impurities brought to the surface.

### 3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match

before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
  - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - b. When total quantity of a given class of concrete is less than 50 cu. yd., Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.
3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
  - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
  - a. Test two field-cured specimens at 7 days and two at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- E. Check slab for compliance with specified floor flatness tolerances in accordance with ASTM E 1155.
- F. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete. Core tests will be required.

H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

END OF SECTION

BARBER FOODS  
ADMIN/SECURITY VESTIBULE

CAST-IN-PLACE CONCRETE



## SECTION 04810

### UNIT MASONRY ASSEMBLIES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
1. Concrete masonry units.
  2. Mortar and grout.
  3. Reinforcing steel.
  4. Masonry joint reinforcement.
  5. Miscellaneous masonry accessories.
- B. Products installed, but not furnished, under this Section include the following:
1. Steel lintels for unit masonry, furnished under Division 5 Section "Metal Fabrications."
  2. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

##### 1.2 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

##### 1.3 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Each type of masonry unit required.
    - a. Equivalent thicknesses and materials used for rating of CMU for each rating indicated on the drawings.
  2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
  3. Each material and grade indicated for reinforcing bars.
  4. Each type and size of joint reinforcement.
- D. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements. Coordinate with General Contractor's procedures for enclosures and heating.

#### 1.4 QUALITY ASSURANCE

- A. **Fire-Resistance Ratings:** Where indicated, provide masonry materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, as acceptable to authorities having jurisdiction.

#### 1.5 PROJECT CONDITIONS

- A. **Protection of Masonry:** During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
  2. Where one wythe of masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. **Stain Prevention:** Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. **Cold-Weather Requirements:** Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates or setting beds. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with the following requirements:
1. **Cold-Weather Construction:** When the anticipated daytime low temperature is within the limits indicated, use the following procedures:
    - a. 40 to 32EF (4 to 0EC): Heat mixing water or sand to produce mortar temperatures between 40 and 120EF (4 and 49EC).
    - b. 32 to 25E F (0 to -4EC): Heat mixing water and sand to produce mortar temperatures between 40 and 120EF (4 and 49EC). Heat grout materials to produce grout temperatures between 40 and 120E F (4 and 49EC). Maintain mortar and grout above freezing until used in masonry. Use heat on both sides of walls under construction. Coordinate with General Contractor for heating both sides of walls under construction.
    - c. 25 to 20EF (-4 to -7EC): Heat mixing water and sand to produce mortar temperatures between 40 and 120EF (4 and 49EC). Heat grout materials to produce grout temperatures between 40 and 120EF (4 and 49EC). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40EF (4EC) if grouting. Coordinate with General Contractor to provide enclosures and

heat both sides of walls under construction to maintain temperatures above 32EF (0EC) within the enclosures.

- d. 20EF (-7EC) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120EF (4 and 49EC). Heat grout materials to produce grout temperatures between 40 and 120E F (4 and 49EC). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40EF (4EC). Coordinate with General Contractor to provide enclosures and heat both sides of walls under construction to maintain temperatures above 32EF (0EC) within the enclosures.

2. Cold-Weather Protection: When the anticipated daytime low temperature is within the limits indicated, coordinate with the General Contractor to provide the following protection. This is in addition to construction procedures specified above:

- a. 40 to 32EF (4 to 0EC): Cover masonry with insulating blankets for 48 hours after construction.
  - b. 32EF (0EC) and Below: Provide enclosure and heat to maintain temperatures above 32EF (0EC) within the enclosure for 72 hours after construction.
3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40EF (4EC) and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. Hot-Weather Requirements: Coordinate with the General Contractor to protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

## PART 2 - PRODUCTS

### 2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners, unless otherwise indicated.
3. Provide square-edged units for outside corners, unless indicated as bullnose.
4. Provide masonry units for fire-rated construction that conform to National Concrete Masonry Association (NCMA) TEK 7-1, fire resistance (1995) including materials and equivalent thicknesses as established therein.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to the following dimensions:
  - a. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

## 2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
  - 1. Blue Circle Cement, Inc.: Eaglebond High Strength Type "S".
  - 2. Ciment Quebec, Inc.: Portland and Lime / Type S.
  - 3. Dragon Cement and Concrete: Type S Masonry Cement.
- D. Aggregate for Mortar: ASTM C 144.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Potable.

## 2.3 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

## 2.4 MASONRY JOINT REINFORCEMENT

- A. Interior Block Wall Reinforcement: Truss type, ASTM A641, mill galvanized, No. 9 wire.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Duro-wall; Dur-O-Truss.
    - b. Hohmann & Barnard; Truss-Mesh, #120.
    - c. Wire-Bond; Series 300, Single Wythe.

## 2.5 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
  - 1. Nonheaded bolts, bent in manner indicated, typical unless headed bolts are indicated.
  - 2. Headed bolts, where indicated.
- B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Type: Expansion anchors.

2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild), use at interior walls.
3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
4. For Postinstalled Anchors in Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

## 2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A.I; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
  1. Holmann & Barnard: #NS – Closed Cell Neoprene.
  2. Wire Bond: 3000 Horizontal.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
  1. Available Products: Subject to compliance with requirements, positioners that may be incorporated into the Work include, but are not limited to, the following:
    - a. D/A 811; Dur-O-Wal, Inc.
    - b. D/A 816; Dur-O-Wal, Inc.
    - c. No. 376 Rebar Positioner; Heckman Building Products, Inc.
    - d. #RB Rebar Positioner; Hohmann & Barnard, Inc.
    - e. #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
    - f. Double O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.
    - g. O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.
- C. Grout Screen: Monofilament screen fabricated from high-strength, non-corrosive, polypropylene polymers.
  1. Available Products: Subject to compliance with requirements, grout screen materials that may be incorporated into the Work include, but are not limited to, the following:
    - a. AA3260; AA Wire Products.
    - b. Dur-O-Stop; Dur-O-Wal, Inc.
    - c. MGS; Hohmann and Barnard.

## 2.7 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
  1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
    - a. 202V Vana-Stop; Diedrich Technologies, Inc.
    - b. Sure Klean Vana Trol; ProSoCo, Inc.

## 2.8 MORTAR AND GROUT MIXES

BARBER FOODS  
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UNIT MASONRY ASSEMBLIES  
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- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
  2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate with General Contractor for enclosures and heating requirements.

#### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.
- F. Bracing Walls During Construction: It is the sole responsibility of the masonry contractor to design and provide temporary bracing of masonry walls during construction. Refer to NCMA Tek Bulletin 3-4B and applicable OSHA standards. Provide 3' vinyl construction fencing around Restricted Zones.

### 3.3

#### CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

### 3.4

#### LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
1. One-half running bond with vertical joint in each course centered on units in courses above and below.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half-running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
  - 1. At non-fire-rated partitions, install compressible filler in joint between top of partition and underside of structure above.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
  - 1. With full mortar coverage on horizontal and vertical face shells.
  - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
  - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

### 3.6 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
  - 1. Space reinforcement not more than 16 inches (406 mm) o.c. unless noted otherwise.
  - 2. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
    - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.7 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
  - 1. Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.



2. Extend horizontal reinforcement beyond the opening a minimum of 40 bar diameters, but not less than 24 inches.
  3. Where steel lintels are utilized in concrete masonry openings, construct a bond beam above the steel with 2 #4 bars. Extend 24 inches beyond the opening.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

### 3.8 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
1. Layout vertical reinforcement with specified jamb reinforcement 4" from each corner, control joint, and opening jamb. Space bars between at a uniform spacing that does not exceed the spacing specified, rounded to the nearest 8". Maximum spacing shall not exceed 48" in any location.
  2. Minimum splice length for deformed bar reinforcement shall be 48 bar diameters. Secure lap splices by tying with wire.
  3. Secure reinforcement in place before placing grout. For vertical reinforcement, use one of the following methods:
    - a. Secure bar at the bottom of each grout lift by tying to dowels. Build masonry around reinforcement. Install rebar positioners at the top of each bar and at a maximum spacing of 192 bar diameters.
    - b. Install rebar positioner at the bottom course of the grout lift, located within 4 inches of the dowel to be spliced. Lay up masonry units. Set vertical bar in the rebar positioner. Install additional rebar positioners at the top of the bar, and at a maximum spacing of 192 bar diameters.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  2. Definitions:
    - a. Grout Lift - Grout placed in one continuous operation. The maximum time span for the grout placement in one lift is 1-1/2 hours measured from the time water is added to the grout mix. The minimum time span between successive grout lifts is one hour.
    - b. Grout Pour - The height of masonry to be grouted prior to the erection of additional masonry.
  3. Provide cleanout holes at least 3 inches (76 mm) in least dimension for grout pours over 60 inches (1524 mm) in height.
    - a. Provide cleanout holes at each vertical reinforcing bar.
  4. Where grouting of cells does not extend the full height of the wall, install specified grout stop at the bottom of lift.
  5. Consolidate grout with a mechanical vibrator.

- a. Use a low velocity vibrator with a 3/4 inch head.
- b. Vibrate each cell in concrete masonry units twice. Insert vibrator to bottom of lift and activate for 1 to 2 seconds.
- c. Perform initial consolidation at each cell immediately after grout placement.
- d. Perform reconsolidation in each cell by reinserting vibrator when grout is still plastic.

### 3.9 FIRESTOPPING

- A. Firestopping: Refer to Division 7 Section "Through-Penetration Firestop Systems" for installation requirements. Provide firestopping, as part of the work of this section, at the top of fire-rated masonry walls between top of partition and underside of structure above, both for new and existing conditions. Where gypsum wallboard is installed at the top of rated existing masonry walls, the firestopping will be provided by others.
  1. Bearing walls, not subject to vertical movement, may be grouted solid between top of wall and underside of structure, in lieu of firestopping.

### 3.10 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.
- 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 Engineer'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, polyethylene film, or waterproof masking tape.
  4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
  5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces. Where efflorescence occurs, clean as recommended in NCMA TEK 8-3A.

### 3.11 MASONRY WASTE DISPOSAL

- A. Excess Masonry Waste: Remove excess, clean masonry waste and legally dispose of off Owner's property.