DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Cast-in-place concrete and reinforcing steel for concrete slabs and footings. Work shall be in conformance to Section 39 - Portland Cement Concrete and Section 48 - Reinforcing Steel of the Standard Specifications.

1.03 QUALITY ASSURANCE

A. Codes: Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”

2. ACI 318 “Building Code Requirements for Reinforced Concrete”

3. ACI 304, “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”

4. ACI 311, “Recommended Practice for Concrete Inspection”

B. Concrete Testing Service

1. The Contractor will employ, at his own expense, a testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests. This laboratory shall be the official testing agency for this project.

2. Materials and installed work may require testing and retesting, as directed by the Engineer, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Test, if not specifically indicated to be done at the Department’s expense, including the retesting of rejected materials and installed work, shall be done at the Contractor‘s expense.

3. Tests shall comply with ASTM Standards whenever applicable.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I

B. Aggregates: ASTM C33

1. Fine Aggregates: Clean, sharp, natural sand or rocksand as manufactured locally free from loam, clay, lumps or other deleterious substances.

2. Coarse Aggregates: Clean, uncoated, processed aggregate containing no clay, mud loam or foreign matter.

C. Reinforcing:

1. ASTM A615-51, Grade 60
2. ASTM A185, galvanized welded wire fabric

2.02 CONCRETE ADMIXTURES

A. Air-Entraining Admixtures: ASTM C260

B. Water-Reducing Admixtures: ASTM C494, Type D

C. Set Control Admixtures: ASTM C494, as follows:

1. Type B, retarding
2. Type D, water-reducing and retarding

D. Calcium Chloride: Do not use calcium chloride in concrete.

2.03 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete; 28-day compressive strengths shall be 3,000 psi (Class A); 2,500 psi (Class B); 2,000 psi (Class C) and in the Standard Specifications. Submit concrete mix design to engineer for review and approval at least two weeks prior to concrete pour.

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required.

C. Unless otherwise noted, Class A concrete shall be used for all electrical ducts, reaction blocks, slabs and walls; Class B concrete for curb and gutter, and sidewalk applications.

2.04 JOINT MATERIALS

A. Premolded Joint Fillers: Premolded material of specified thickness composed of fiberboard impregnated with asphalt.

B. Joint Sealing Compound: Tremco Butyl Sealant or approved equal.

C. Epoxy-Resin Bonding Agent: Two component, mineral filled epoxy polysulfide

polymer complying with FS MMM-G-650, Type I or Type II, Grade A.

2.05 MOISTURE BARRIER: Provide moisture barrier over prepared base material where shown on plans. Use only materials which are resistant to decay when tested in accordance with ASTM E154, as follows: Polyethylene sheet not less than 6 mils thick.

2.06 CURING MATERIALS

A. Curing compounds for membrane curing shall conform to ASTM C309.

B. Liquid Curing - Hardening Compound: Aqueous solution of sodium silicate with non-acid penetrating agent, reacting chemically with free lime in concrete to form a hard, non-dusting surface which will not inhibit bonding with future finishes. Products offered by manufacturers to comply with the requirements for liquid curing hardening compounds include the following:

1. Demicon: Castle Chemical Corp.
2. Eucosil: Euclid Chemical Co.
3. Chem Hard: L&M Construction Chemicals

2.07 EPOXY GROUT: Manufactured grout with built-in bonding material subject to approval of the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION: Pre-Placement Inspection -- Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.

3.02 CONCRETE PLACEMENT

A. General: Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.

2. Screen concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been

contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

B. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris water, and other deleterious materials.

C. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to the correct level with a straightedge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

4. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

D. Dowel installation where shown. Prepare for bonding of dowels and anchors to existing concrete by using drilled holes and a two-component epoxy which is manufactured for this specific purpose. Install in accordance with manufacturer's requirements to develop strength of dowels.

3.03 CONCRETE SLAB FINISHES

Slabs: Finish by tamping the concrete to force aggregate away from the surface and screen at the proper level. Float the surface and lightly trowel. When concrete has set sufficiently to ring under the trowel, give a second troweling to produce a smooth, dense surface free from trowel marks and sweeps, air bubbles or other imperfections of troweling.

3.04 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

1. Perform curing of concrete by moist curing, or by moisture retaining cover curing, by membrane curing, or by combinations thereof, as herein specified for a continuous period of 14 days.

2. Liquid Curing-Hardening Compound: Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray, or hair broom in accordance with manufacturer's directions.

C. Curing Unformed Surfaces

1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing, whenever possible.

2. Moist cure surfaces to receive fluid applied waterproof membranes and composition flooring. Do not cure by membrane curing or curing compounds.

3. All slabs not receiving a finish floor material shall receive a liquid curing-hardening compound in accordance with the manufacturer's recommendations.

4. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

D. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.05 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures from the passage of work by other trades, unless otherwise shown or directed, after the work or other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Epoxy Adhesive: For application on corrective work where the ordinary methods of remedy are deemed inadequate by the Engineer. Type of adhesive shall be subject to the approval of the Engineer.

3.06 CONCRETE SURFACE REPAIRS

A. Repair of Unformed Surfaces

1. Test unformed surfaces such as monolithic slabs, for smoothness and to verify surface plane to the tolerance specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finish unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include cracks in excess of 0.03 inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

B. Finishing of Formed Surfaces

1. Joint marks and fins shall be removed and surfaces left smooth and dense. Tieholes and honeycombing shall be repaired with cement and sand mortar.

2. Exposed concrete surfaces shall be vigorously and thoroughly rubbed with a sand cement mortar the consistency of a thick paint to fill all voids and provide a smooth surface. There shall be no discernible thickness of mortar on the surface.

END OF SECTION

DIVISION 4 - MASONRY

SECTION 04220 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 SUBMITTALS: The masonry manufacturer's certification that the masonry units comply with ASTM C90 and the curing requirements specified herein shall be submitted to the Engineer upon request.

1.03 SAMPLE BLOCKS: A sample of each of the masonry units required shall be submitted for approval to the Engineer upon request.

1.04 DELIVERY, STORAGE AND HANDLING

A. Masonry Units: Masonry units delivered to the jobsite shall conform to the moisture content requirements as specified under ASTM C90. Masonry units shall be stored off the ground and protected from inclement weather and physical damage. All units shall be handled with reasonable care to prevent marring or damaging of faces, edges and corners of units. In no case shall dumping of units from hand trucks or wheelbarrows be permitted.

Where used in exposed wall construction, any unit with exposed face or faces having chips, cracks, or other imperfections more than 1 inch in dimension shall be rejected.

B. Mortar and Grout Materials: Portland cement, masonry cement, mortar cement, lime and admixtures shall be stored in such a manner as to prevent deterioration or contamination with foreign matter. Cement which has become caked, partially set or otherwise deteriorated, or any material which becomes damaged or contaminated, shall be rejected.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The Contractor shall ensure that all materials and equipment incorporated in the project are asbestos-free.

B. Hollow Concrete Masonry Units shall be gray split faced, load-bearing units and shall conform to the requirements of ASTM C90, "Standard Specifications for Load-Bearing Concrete Masonry Units," Type II, nonmoisture-controlled units. Units shall be 2-core type, 8-inch nominal height, 16-inch nominal length and width as indicated on the plans.

All units shall be sound, free of cracks, straight and true. They shall be either steam-cured or cured under atmospheric conditions for a minimum of 30 days.

C. Portland Cement shall conform to ASTM C150, Type I or Type II.

D. Mortar Cement (Type M) shall conform to the requirements of UBC Standard No. 24-19 “Mortar Cement.” Conformance to this standard shall be noted on the material package. (“Supermortar” by Hawaiian Cement, or approved equal.)

E. Hydrated Lime shall conform to the ASTM C207, Type S.

F. Aggregate for use in mortar shall conform to ASTM C144.

G. Aggregate for use in grout shall conform to ASTM C404, with grading in accordance with ASTM D448, No. 10.

H. Water used in mixing mortar or grout shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to either the mortar or reinforcement. Non-potable water shall not be used.

I. Horizontal Reinforcement shall be trussed or ladder design with #9 gauge, deformed side rods and welded #12 gauge or larger cross rods (“Dur-O-Wal,” “Blok-Mesh,” or approved equal), or as otherwise indicated on the plans.

J. Reinforcing Steel shall be deformed bars conforming to ASTM A615-51, Grade 60.

K. Rebar Wire Positioners shall be galvanized, No. 9 gauge wire, manufactured positioners per ASTM A82 or other suitable devices.

L. Additives/Admixtures for mortar shall be “Easy Spred” by American Colloid Co., “MRF” by Gibco Industries, Inc., or approved equal.

PART 3 - EXECUTION

3.01 MORTAR AND GROUT

A. The proportioning of materials for mortar and grout shall be by volume and done in such manner that the specified proportions can be controlled and accurately maintained. Fine aggregate shall be measured in a damp loose condition. Mixing shall be by a mechanical batch mixer for at least 3 minutes for mortar and 5 minutes for grout, but for not more than 10 minutes. Hand mixing shall be permitted only for small batches of 3 cubic feet or less.

B. Mortar shall be freshly prepared and uniformly mixed in one of the following proportions.

1. Type M - Cement-Lime Mortar:
   1 part Portland cement
   1/4 part hydrated lime
   3 to 3-3/4 parts mortar aggregate

2. Type S - Cement-Lime Mortar:
   1 part Portland cement
   1/4 to 1/2 part hydrated lime
   Mortar aggregate: Not less than 2-1/4 and not more than 3 times the sums of the separate volumes of cementitious materials.

3. Type M - Mortar Cement Mortar:
   1 part mortar cement
   2-1/4 to 3 parts mortar aggregate

   Sufficient water shall be used to provide a workable consistency. Mortar shall be used and placed in final position within 1-1/2 hours after mixing.

4. Type M Mortar:
   2 sacks Portland cement
   1/2 to 1 - 7 lb. bag Easy Spred
   6 cu. ft. mortar aggregate

5. Type M Mortar:
   1 sack Portland cement
   3 ounces MRF
   2-1/4 to 2-3/4 cu. ft. mortar aggregate

6. Type S Mortar:
   2 sacks Portland cement
   1 - 7 lb. bag Easy Spred
   9 cu. ft. mortar aggregate

7. Type S Mortar:
   1 sack Portland cement
   3 ounces MRF
   2-1/2 to 3 cu. ft. mortar aggregate

   The above mixes 4 through 7 shall be prepared strictly in accordance with the manufacturer's instructions. Placement of the mortar shall be completed within 2-1/2 hours after mixing. No materials which start to set shall be retempered.

C. Grout (coarse) mixed on-site shall conform to ASTM C476 and shall be freshly prepared and uniformly mixed in the following proportion:

1 part Portland cement
0 to 1/10 part hydrated lime
Fine Aggregate: 2-1/4 to 3 times the sum of the volumes of the cementitious materials. Coarse Aggregate: 1 to 2 times the sum of the volumes of the cementitious materials.

Grout designed by ready-mix suppliers may be used upon approval of the Engineer.

Sufficient water shall be used to produce a consistency just fluid enough for pouring or pumping without segregation. Grout shall be used and placed in final position within 90 minutes after mixing, but shall in no case be used after initial set has occurred.

In any event, the grout shall attain not less than 2,500 psi 28-day compressive strength per ASTM C1019 unless noted otherwise on plans.

3.02 REINFORCEMENT

A. Reinforcement shall be free from scale, loose flaky rust or other coatings that will destroy bond. It shall be straight except for bends around corners or where bends or hooks are detailed. Size and spacing shall be as indicated on the plans.

B. Vertical reinforcement shall be accurately placed and secured against displacement by rebar wire positioners at top and bottom and at intervals not to exceed 200 diameters of the reinforcement (8 feet for #4 bars; 10 feet for #5 bars). Dowels and splices shall be lapped as indicated but not less than 30 diameters or 15 inches, whichever is longer. At ends of walls, one #5 bar shall be installed in the end cell unless heavier reinforcement is otherwise called for on the plans and that cell shall be filled with grout.

3.03 ANCHORS: Work with other trades shall be coordinated as necessary to set into tile walls all anchors, bolts, nailing blocks, etc. Anchors shall be grouted around with sufficient mortar to make them secure.

3.04 LAYING

A. General: All masonry units shall be clean and dry and shall be handled so that edges and faces will not be chipped, spalled, or cracked. All beds on which masonry is to be laid shall be cleaned. All work shall be built plumb, level, and true, within the tolerances specified below, and shall be laid up with whole units except at closures.

Masonry units in walls shall be laid so that one face of the wall is a true flat plane. Unless otherwise indicated on the plans, this shall be on the inside face. All cutting and fitting as may be required for and necessary to accommodate other trades shall be done neatly using a power driven carborundum saw. It shall be the responsibility of the Contractor to control any dust pollution caused by the cutting operations. All drilling and cutting of small holes shall be neatly

done. Bolts, anchors, ties, conduits, and similar items required for the installation of work under other sections of these specifications shall, as far as practicable, be placed as the work progresses. All walls shall be carried to the height as shown on plans, and shall be capped at the top as shown on the plans.

B. Allowable Tolerances

1. Variation from the Plumb

a. In the lines and surfaces of columns, walls and arrises:

in 10 ft. 1/4”

b. For external corners, control joints and other conspicuous lines:

in any story or 20 ft. max. 1/4”

2. Variation from the level or grades indicated on the plans:

For exposed horizontal grooves and other conspicuous lines:

in any bay or 20 ft. max. 1/4”

3. Variation of the linear building lines from established position in plan and related portion of columns and walls:

in any bay or 20 ft. max. 1/2”

4. Variation in cross—sectional dimensions of columns and in the thickness of walls:

minus 1/4”; plus 1/2”

5. Checking and setting

The following tools and methods shall be the minimum or acceptable type:

a. Plumb and level shall be determined by level and/or pull string method.

b. An instrument at least 4 feet long shall be used for leveling or runs. A shorter level may be used for cross-leveling of units.

C. Masonry units shall not be wet before being used and units which have gotten wet shall be thoroughly dried before being used. Where no bond pattern is shown, the wall shall be laid up in straight uniform course with regular running bond.

D. Masonry units in first course shall be laid with shell mortar beds not exceeding 3/4 inch in thickness. Webs of adjoining cells containing reinforcement shall also be bedded in mortar to prevent escape of grout.

Vertical head joints shall be mortared well for a thickness equal to the face shell of the block and these joints shall be shoved tightly so that the mortar bonds well to both blocks. Joints shall be solidly filled from the face of the block to the depth of the face shell.

E. If it is necessary to move a block so as to open a joint, the block shall be removed from the wall, cleaned and reset in fresh mortar.

F. Mortar joints shall be straight, clean and in a thickness of 3/8 inch + 1/8 inch. All exposed horizontal and vertical joints shall be tooled with a 1/2-inch to 5/8-inch round bar at least 14 inches long to produce a dense, slightly concave surface well-bonded to the block at the edges. Tooling shall compact the mortar, pressing the excess mortar out of the joint rather than gouging it out. Use a 3/8 inch diameter half-round molding to simulate a concave horizontal joint between a concrete bond beam and the hollow tile wall below.

Where walls are to receive plaster or where they are not exposed, such as below finish grade and where special glazed finish is indicated, the joints shall be struck flush.

G. All hollow masonry units shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Walls and cross webs forming such cells shall be full-bedded in mortar to prevent the leakage of grout.

H. All cells containing reinforcement shall be filled solidly with grout in lifts not exceeding 8 feet unless otherwise shown on the plans. Other cells, where indicated to be solid for anchors or such items, shall also be filled. When grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout 1-1/2 inches below the top of the uppermost unit.

I. Care shall be taken to prevent mortar splotches. All forms shall be made tight and concrete or grout spilled on the wall shall be washed off immediately before it can set up. Walls shall be protected against stains and excess mortar shall be wiped off the surface as the work progresses. After the wall is constructed, it shall not be saturated with water for curing, cleaning, etc.

3.05 PROTECTION AND CLEANING

A. While masonry walls are being built, they shall be protected when not being worked on to prevent rain from saturating the wall. Covering of suitable materials such as canvas or plastic sheeting shall be placed atop the wall and shall extend at least 2 feet on either side of the wall. Covering shall be weighted down to prevent it from being lifted by the wind.

B. At the completion of the work, all holes or defective mortar joints in exposed masonry shall be pointed and where necessary defective joints shall be cut out and repointed. All exposed masonry shall be thoroughly cleaned of mortar drippings, sand and splotches during the course of the work. No smoothing of a wall surface which produces a “bright spot” when painted will be accepted. All adjoining work subject to damage shall be carefully protected.

C. Upon completion of work, all surplus, waste materials, rubbish and debris shall be removed from the premises, leaving same in clean and satisfactory condition.

END OF SECTION