

## SECTION 03100

### CONCRETE FORMWORK

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Provide required formwork and related accessories for proper construction of cast-in-place structural concrete work.
- B. Work, items and requirements specified elsewhere that apply and/or relate to this Section include:
  - 1. Drilled Piers - Section 02362.
  - 2. Concrete Reinforcement - Section 03200.
  - 3. Cast-in-place concrete - Section 03300.

##### 1.2 WORK INSTALLED BUT FURNISHED IN OTHER SECTIONS

- A. Built-in-anchors, inserts and bolts for connection of other materials.
- B. Built-in-sleeves.

##### 1.3 QUALITY ASSURANCE

- A. Design criteria: Conform to ACI 347-(Latest Edition).
  - 1. The design and engineering of formwork, as well as its construction, shall be the responsibility of the contractor.
- B. Allowable Tolerances: Conform to ACI 117-(Latest Edition).

##### 1.4 STORAGE OF MATERIALS

- A. Store form materials and accessories on dunnage and under cover of protective sheeting.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Forms:
  - 1. Framing: Kiln dried softwood lumber, PS 20-70.
  - 2. Plyform: B-B plyform, sanded, Class I, EXT-DEPA, grade trademarked of APA, PSI-66. Fiber or metal forms may be used in lieu of plywood, subject to Architect's approval.
  - 3. Void Forms: Sizes as indicated on drawings.
    - a) Provide and install a complete, closed cell, void form system that effectively isolates the structural/foundation elements from the soil. Provide all components, connectors, seam covers, tape, sealant, end closures, protective boards, moisture barriers, etc., necessary to complete the installation. Provide products suitable for use under the designated elements.
    - b) Void form components shall consist of corrugated paper material with a moisture resistant exterior, and having an interior fabrication of a uniform cellular configuration that is composed of non-wax impregnated components. Void forms are temporary forms and shall decompose after placement of concrete. Void forms shall be biodegradable.
    - c) Design void forms to fully support the weight of wet concrete shown in sections and details and temporary construction loading until the loads can be supported by the concrete structure.
    - d) The manufacturer shall provide written confirmation of their product's ability to perform satisfactorily under the design conditions.

- e) Void forms for grade beams and walls shall be rectangular forms matching the width of grade beam or wall. Approved products include WallVoid and Seam Pads as manufactured by SureVoid Products, Inc., Englewood, CO. (800) 458-5444, or approved equal.
  - f) Provide side retainer boards on each side of all pier caps and grade beams . Retainer boards shall be high-density polyethylene, lightweight, flexible retainer block to prevent migration of backfill under suspended building foundation. Retainer shall extend above and below void form depth, have sufficient strength to resist lateral loads applied by soil, and be impact resistant. Retainer shall be capable of being exposed to earth and moisture without deterioration. Approved products include SureRetainer by Motzblock, as supplied by SureVoid Products, Inc., (888) 803-8643, or approved equal.
  - g) Voids that abut piers shall properly void the circular edge of all drilled piers. Use pre-manufactured, non-field cut, sealed void forms, with curved, radial, vertical edges adjacent to the piers. Approved products include ArcVoid and SureRound PierVoid as manufactured by SureVoid Products, Inc., Englewood, CO. (800) 458-5444, or approved equal.
4. Pier Top Forms: Sizes (interior diameter) to match pier diameters shown on drawings. Provide cylindrical forms of sufficient strength to properly form upper portions of concrete piers without distortion. Approved products include Commercial Sure Tops as manufactured by SureVoid Products, Inc. (Englewood, Co. (800) 458-5444).
- B. Pan Forms: Metal or fiberglass pan forms designed to support wet concrete without deflection. Provide new forms or properly reconditioned used forms. Provide required end closures.
    - 1. Metal: 18 gauge steel.
    - 2. Fiberglass: Molded fiberglass - reinforced plastic, alkali-resistant contact faces, long-form type.
  - C. Rustications, Bevels, and Chamfers: Mill from Northern White Pine, smooth and free of irregularities.
  - D. Shores: Patented shores of adequate strength and bracing to safely support imposed loads.
  - E. Form Oil: Non-staining, paraffin-base oil having a specific gravity of between 0.8 and 0.9.
  - F. Form Ties: Bolts, rods, or patented devices having a minimum tensile strength of 3,000 lbs., adjustable in length, free of lugs which would leave a hole larger than 5/8" in diameter and having a full one-inch depth of break-back.

## 2.2 SUBMITTALS

- A. Submit in accordance with Division 1.
- B. Product Data: For each type of forming product including all void form products and accessories. Product data shall indicate compliance with specifications, instructions for proper storage and installation, protection of materials from moisture prior to concrete pour and guidelines/instructions for evaluation of products if they are exposed to moisture.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION AND ERECTION

- A. Construct forms in accordance with ACI 347. All elements of the forms, formwork, bracing and shoring shall consist of wood, metal or other manufactured products as specified above. Earth may not be used as a form, either directly or indirectly. Neither earth trenches nor earth trenches lined with another material are acceptable.
- B. Build forms to conform to shapes, lines and dimensions of detailed member of concrete

- construction. Set to line and grade, and brace and secure to withstand placing of concrete and maintain their shape and position.
- C. Construct forms with care to produce concrete surfaces without unsightly or objectionable form marking exposed concrete surfaces. Provide temporary inspection and clean out openings in bottom of wall and column forms and elsewhere as required by Architect. Seal joints after closing.
  - D. Thoroughly clean surfaces of form material and remove nails before reuse. Do not reuse damaged or worn forms. Coat contact surfaces of forms with non-staining form oil prior to placing metal reinforcement.
  - E. Install void form system in strict conformance with the manufacturer's recommendations.
    - 1. The manufacturer's representative shall conduct a pre-construction meeting to instruct the work force on proper storage, installation, and concrete placement.
    - 2. Properly void the circular edge of all drilled piers at the intersection with grade beams, walls, pier caps, or structural slabs. Use pre-manufactured, non-field cut, sealed void forms, with curved, radial, vertical edges adjacent to the piers.
    - 3. Cover all joints and seams, and seal all exposed ends, to eliminate concrete flow into the void.
    - 4. Install side retainers where rectangular forms have been used beneath pier caps, grade beams and walls.
    - 5. Protect slab forms from puncture and other damage during concrete placement with a layer of protective cover board (1/8" thick masonite or plywood sheet) over forms. Replace all units that become damaged prior to pouring concrete.
    - 6. Void forms shall remain dry during construction. Replace all units that are exposed to moisture.
  - F. Immediately before placing concrete, clean forms of chips, sawdust, and other debris. Immediately after removal of forms, remove form ties, wires and other defects and patch.
- 3.2 INSERTS AND ACCESSORIES
- A. Make provisions for required installation of accessories, bolts, hangers, sleeves, anchor slots and inserts cast in concrete, as required by Drawings and other trades. Obtain suitable templates or instructions for installation of items. Place expansion joints where detailed and required.
- 3.3 REMOVAL OF FORMS AND SHORING
- A. Removal of forms and shores shall be in accordance with ACI 347.
  - B. Do not remove shoring until members have acquired specified design strength required to support their own weight and loads. For post-tensioned elements, do not remove shoring until members have acquired a minimum compressive strength as stated in the General Notes and post-tensioning operations are complete.
- 3.4 FIELD QUALITY CONTROL
- A. The General Contractor shall perform a visual inspection of the void form installation prior to inspection by the testing laboratory.
  - B. Immediately prior to the concrete pour, the testing laboratory shall inspect the void form installation for size, placement, and quality of construction and materials. The testing laboratory shall review and inspect the following:
    - 1. Review manufacturer's certification that units are designed to support the wet weight of the concrete.
    - 2. Confirm that the actual product used matches the product submittals.
    - 3. Verify size (both width and depth) of void forms.
    - 4. Confirm placement matches construction documents.
    - 5. Inspect the installation of void forms for tightness of fit, closure of ends, closure of

circular formed edges adjacent to piers, adequacy of sealed seams and joints, firmness of installation (firm enough to prevent displacement during concrete placement), and integrity of units. Units that have been damaged by mechanical means or moisture shall be replaced.

**END OF SECTION**

## SECTION 03200

### CONCRETE REINFORCEMENT

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Provide steel reinforcement for cast-in-place concrete.
- B. Work, items and requirements specified elsewhere that apply and/or relate to this Section include:
  - 1. Quality Control – Division 1
  - 2. Concrete Formwork - Section 03100.
  - 3. Cast-in-place concrete - Section 03300.

##### 1.2 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Division 1. Indicate complete reinforcing for each concrete member including materials, sizes, bends, dimensions, bar schedules, stirrup spacing, and placing details.

##### 1.3 DELIVERY AND STORAGE

- A. Stack reinforcing steel in tiers and mark so that each length, size, shape and location can be readily determined. Exercise care to maintain reinforcement free of dirt, mud, paint, rust, grease or oil.

##### 1.4 RELATED SPECIFICATIONS

- A. ACI 318 "Building Code Requirements for Reinforced Concrete", Latest Edition.
- B. CRSI "Manual of Standard Practice" Latest Edition.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Steel Reinforcement: Deformed billet steel, ASTM A615, Grade 60, unless noted otherwise on Drawings. Deformed billet steel, ASTM A615, Grade 75, as noted on drawings. When welding of reinforcement is required, use all grade 40 bars, or establish weldability in accordance with AWS D12.1.
- B. Welded Wire Fabric: ASTM A185, as indicated on contract drawings.
- C. Miscellaneous Accessories: Provide spacers, chairs, ties, and other devices necessary for properly placing, spacing supporting and fastening reinforcement in place.

##### 2.2 FABRICATION

- A. Fabricate reinforcing steel to sizes, shapes, and lengths detailed in accordance with requirements of ACI 318, and CRSI Manual of Standard Practice.

#### PART 3 - EXECUTION

##### 3.1 INSTALLATION

- A. Accurately place reinforcing steel of sizes, shapes, lengths, spacing and other dimensions in accordance with approved Shop Drawings and CRSI Manual of Standard Practice. Before placing, thoroughly clean reinforcement of any coating which would reduce bonding. Do not heat, cut, or bend bars without Architect's approval. Do not splice reinforcement at points of

maximum stress. Stagger splices in adjacent bars and provide a minimum overlap of 30-bar diameters at splices unless specifically noted otherwise on Drawings.

- B. Securely tie at intersections with black annealed wire. Rigidly secure reinforcement in place during concrete placing. Provide concrete coverage for reinforcing as shown on Drawings.

### 3.2 FIELD QUALITY CONTROL

- A. The General Contractor shall perform a visual inspection of all reinforcing steel for correctness of placement, sizes, quantities, grades and supports, prior to the inspections performed by the Testing Agency.
- B. The Contractor shall provide sufficient time between completion of placement of reinforcing steel and beginning of concreting to allow complete inspection by the Testing Agency and correction of all errors. Placement of reinforcing steel shall be complete prior to inspection by the Testing Agency. The Contractor shall give the Testing Agency at least 24 hours notice of when their services will be required.
- C. The designated Testing and Inspection Agency shall perform the following reviews and inspections:
  - 1. The steel supplier shall furnish mill certificate reports (written in English) for the Testing Agencies' review.
  - 2. Prior to placement, visually inspect and report on size, type, grade and quality of materials.
  - 3. Observe and report on placement of reinforcement, including size, quantity, vertical location, horizontal location and spacing, correctness of bends, splices and clearances between bars and forms, firmness of installation, and security of supports and ties, immediately prior to concreting.
  - 4. Observe and report on placement of embedded items, including size, vertical location, horizontal spacing, correctness of fabrication, and firmness of installation immediately prior to concreting.
  - 5. Report to the Contractor, Architect, and Engineer all items that deviate from the Contract Documents and/or require clarification prior to concreting. Re-inspect these items after the Contractor has completed the correct installation, just prior to concreting.

**END OF SECTION**

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. Provide reinforced Cast-in-Place concrete work as indicated by the Contract Documents including:
  - 1. Structural concrete.
  - 2. Integrally colored concrete floor toppings.
  - 3. Concrete walks.
  - 4. Concrete site paving.
  - 5. Concrete curbs, aprons, benches.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Testing Laboratory Services: Division 1
- B. Concrete Formwork: Section 03100
- C. Concrete Reinforcement: Section 03200
- D. Color Conditioned Concrete: Section 02754

##### 1.3 SUBMITTALS

- A. Design of Concrete Mixes: Proposed mix designs shall be prepared and/or reviewed and approved for conformance to the Contract Documents by an independent testing laboratory. Submit the proposed mix designs and the testing laboratory's report to the Architect. Mix design methods shall be in accordance with ACI 318.

##### 1.4 COORDINATION

Notify responsible trades of schedules of concrete pours to allow adequate time for installation of their work.

##### 1.5 RELATED SPECIFICATIONS

The specifications of the American Society for Testing Materials and ACI Standard 318, "Building Code Requirements for Reinforced Concrete", Latest Edition, are declared a part of this specification except as modified herein.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Portland cement: ASTM C-150, Type I, or Type II.
- B. Fly Ash: ASTM C618, Class F (Class F blends will not be allowed). Maximum 20% of cementitious material by weight. Fly ash shall not be used in architecturally exposed concrete without expressed approval of the Architect.
- C. Normal Weight Aggregate: ASTM C-33. Provide aggregate from a single source. Free of materials with deleterious reactivity to alkali in cement.
  - 1. Fine Aggregate: Clean, hard durable, uncoated natural sand, free from silt, loam or clay.
  - 2. Coarse Aggregate: Hard, durable, uncoated crushed limestone.
- D. Lightweight Aggregate: Expanded clay or shale coarse aggregate conforming to ASTM C-330. Free of materials with deleterious reactivity to alkali in cement.
- E. Water: Potable.
- F. Admixtures: The following admixtures may be used with approval from the Architect/Engineer (Do not use admixtures containing chloride ions):

1. ASTM C-494 Type A (water-reducing)
  2. ASTM C-494 Type D (water-reducing and retarding)
  3. ASTM C-494 Type E (water-reducing and accelerating)
  4. ASTM C-494 Type F (high range water reducing (HRWR))
  5. ASTM C-260 Air-entraining
- G. Vapor Barrier: 10 mil polyethylene sheet, type recommended for below-grade application and compatible waterproof tape.
- H. Curing/Sealing Compounds: Non-yellowing clear acrylic, ASTM C-309. Verify compatibility with tile setting bonding materials.

## 2.2 PROPORTIONS AND MIXING

### A. Proportions and Design:

1. In accordance with approved mix design for each type of concrete scheduled.
2. Admixtures: Introduce admixtures in quantities and according to methods recommended by admixture manufacturer. Add air-entraining agent to concrete type mixtures where required. Admixtures shall not be used except as specified in the approved mixed design.
3. Strength:
  - a. The strength of the concrete for each portion of the structure shall be as designated on the project drawings. Strength requirements shall be based on 28-day compressive strengths, unless high early strength is specified in which case required strengths shall be obtained at 7 days.

### 4. Slump:

- a. Slump of concrete of normal weight as determined by "Method of Test for Slump of Portland Cement Concrete" (ASTM C-143), shall be as follows:

SLUMP (INCHES)*	MAX.	MIN.
TYPE OF CONSTRUCTION		
Slabs on Metal Deck	4"	2"
Drilled Piers	7"	5"
Concrete Containing HRWR	9"	
All Other Concrete	5"	2"

\* For Concrete to be vibrated

- B. Mixing: Ready mixed concrete in accordance with ASTM C-94. Do not transport or use concrete after one and a half hours have elapsed from time of initial mixing. Supplier of transit-mixed concrete shall have a plant of sufficient capacity, and adequate transportation facilities to assure continuous delivery at required rate, so as to provide for continuous concrete placement throughout a pour.

## 2.3 SOURCE QUALITY CONTROL

- A. Inspection and testing as specified in Division 1.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect foundations, forms, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts, damp-proofing and other work required to be built into concrete. Notify Architect at least one working day in advance of scheduled pour to allow time for adequate observations.
- B. Correct unsatisfactory work prior to pouring concrete.
- C. Remove ice and excess water from excavations and formwork.

### 3.2 CONCRETE PLACEMENT

- A. Placing Concrete:

1. Convey and place concrete in accordance with ACI 304, latest edition, and in such a manner that there will be no separation of ingredients and as specified below.
- B. Consolidation:
  1. Use mechanical vibrating equipment for consolidation.
  2. Vertically insert and remove hand-held vibrators at 18" on center.
  3. Do not use vibrators to transport concrete in forms.
  4. Provide vibrators with minimum speed of 8000 RPM and with sufficient amplitude to consolidate concrete and work around reinforcement, embedded items and into corners of forms. Thoroughly consolidate layers of concrete with previous layers.
- C. Construction Joints: Unless otherwise shown on Drawings, each footing, pier, column, beam, wall and slab shall be considered as a single unit of operation and shall be monolithic in construction. Where construction joints are absolutely unavoidable, locate joints at or near midpoints of spans where approved by Architect. Provide appropriate keys in construction joints, plumb level, whether horizontal or vertical. Place construction joints in exposed concrete work at detailed joints or rustications as approved by Architect.
- D. Expansion Joint Fillers: Place premolded expansion joint fillers at location as detailed. Refer to Drawings for required joint dimensions.
- E. Cold Weather Placement: Do not place concrete when temperature is below 40° F unless cold weather concrete procedures are followed as specified in ACI 306. Calcium chloride or admixtures containing chloride ions shall not be used except where specifically approved by the Architect.
- F. Hot Weather Placement: Exercise special care in accordance with ACI 305 to prevent high temperature in fresh concrete during hot weather. Use water-reducing/set-retarding admixtures in such quantities as especially recommended by the manufacturer to assure that concrete remains workable and lift lines will not be visible. Concrete having a temperature in excess of 95°F will not be permitted without containing a high range water reducing admixture and written certification from the concrete supplier of a successful record of the proposed mix design (Submit mix design with HRWR with a record indicating a maximum tested temperature for Architect/Engineer review prior to use). Cooling of water and/or aggregates will be required if concrete temperatures rise above this limit. When necessary, arrangements for installation of wind breaks, shading, fog spraying, sprinkling, ponding, or wet covering of a light color shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
- G. Finishes:
  1. Smooth-trowel finish: Concrete slabs which are to receive finish floor covering, as well as concrete floors, shall be smooth-trowel finished. Jitterbug or tamp surfaces, screed to proper elevation, then float with metal or wood floats. After concrete has set sufficiently to support weight, use mechanical floats for finish leveling. After water sheen has disappeared from surfaces, trowel with steel trowel to smooth surface free from blemishes and trowel marks. Perform final troweling after concrete is so hard that no mortar accumulates on trowel and a ringing sound is produced as trowels are drawn over surfaces.
  2. Broom Finish: Flatwork shall be broom finished where noted specifically on Drawings. Jitterbug or tamp surfaces, screed to proper elevation, then float with wood floats to obtain a tight wood float finish. Prior to final set of concrete, brush concrete surfaces with a broom with grain running as directed, to a texture to match approved samples.
  3. Patch defective areas which do not match approved finish samples. Chip and patch with a mixture of cement and aggregate to match color of adjacent areas. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly

consolidated into place and struck off to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least one (1) hour before being finally finished. The patched area shall be kept damp for seven (7) days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

- H. Curing and Protection:
1. Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures. Maintain concrete at a relatively constant temperature without drying for the period of time necessary for the hydration of the cement and proper hardening of the concrete.
  2. Curing shall immediately follow the finishing operation. Concrete shall be kept continuously wet by the method of sprinkling or curing compound for a period of not less than 6 days after placing.
  3. During curing period, maintain above 70° F. for at least 3 days, or above 50° F. for at least 5 days. Spray compound on surfaces using two coats, applying second at right angle to first, at rate of 400 sq. ft. per gallon or as recommended by manufacturer. Restrict traffic on surfaces during cure to protect tracking off of protective film.

### 3.3 FIELD QUALITY CONTROL

- A. Routine testing of materials, of proposed mix designs and of resulting concrete for compliance with technical requirements of the specifications shall be the duty of the testing agency.
- B. Testing required because of changes in materials or proportions of the mix requested by the Contractor, as well as any extra testing of concrete or materials occasioned by their failure to meet specification requirements, shall be at the Contractor's expense.
- C. The Designated testing agency shall:
1. Test the Contractor's proposed materials for compliance with the Specifications.
  2. Review and check the Contractor's proposed mix design.
  3. Secure production samples of materials at plants or stockpiles during the course of the work and test for compliance with the Specifications.
  4. Check batching and mixing operations to the extent deemed necessary to assure compliance with the Specifications.
  5. Check slump consistency and uniformity of concrete to the extent deemed necessary to assure compliance with the Specifications.
  6. Conduct strength test of the concrete in accordance with the following procedures.
    - a. Secure composite samples in accordance with "Method of Sampling Fresh Concrete" (ASTM C-172). Each sample shall be obtained from a different batch of concrete on a representative, truly random basis. To be representative, the choice of times of sampling, or the batches of concrete to be sampled are to be made on the basis of chance alone, within the period of placement. Batches should not be sampled on the basis of appearance, convenience, or other possibly biased criteria. When pumping or pneumatic equipment is used, samples shall be taken at the discharge end. Water shall not be added to the concrete after the sample has been taken.
    - b. Mold specimens from each sample in accordance with "Practice for Making and Curing Concrete Test Specimens in the Field" (ASTM C-31). Concrete for [drilled piers, grade beams and pier caps] [foundations, pedestals, pilasters and walls] shall be field cured under field conditions per ASTM C-31. The remainder may be laboratory cured under standard moisture and temperature conditions in accordance ASTM C-31.
    - c. Per ACI 318, each strength test shall consist of the average of strengths of

at least two 6x12 cylinders or at least three 4x8 cylinders. When using 6x12 cylinders, mold five specimens from each sample. When using 4x8 cylinders, mold eight specimens from each sample. The size and number of specimens shall remain constant for each class of concrete.

- d. Test specimens in accordance with "Methods of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C-39).
    - i.) When using 6x12 cylinders, test two specimens at 7 days and two at 28 days. Hold one cylinder for testing at Owner's discretion. The 7-day and 28-day test results shall be the averages of the strengths of the two specimens taken on that date.
    - ii.) When using 4x8 cylinders, test three specimens at 7 days and three at 28 days. Hold two cylinders for testing at Owner's discretion. The 7-day and 28-day test results shall be the averages of the strengths of the three specimens taken on that date.
    - iii.) When early high strength concrete is required, additional specimens shall be taken and tested on the early date (two 6x12 specimens or three 4x8 specimens).
  - e. Samples for strength tests of each class of concrete (each mix design) placed each day shall be taken not less than once a day, nor less than once for each 100 cu. yd. of concrete, nor less than once for each 5,000 sq. ft. of surface area for slabs or walls.
  - f. If the total volume of concrete is such that the frequency of testing required above would produce less than five strength tests for a given class of concrete (mix design), tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
  - g. Low strength test results will be investigated in accordance with ACI 318 methods. Acceptance of 56-day strength tests shall be at the Engineer's discretion and may not eliminate the need for other testing methods.
7. Determine air content of normal weight concrete on a regular and frequent basis in accordance with either ASTM test method.
  8. Determine air content and unit weight of lightweight concrete on a regular and frequent basis in accordance with "Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method" (ASTM C-173) for air content and "Method of Test for Weight per Cubic Foot, Yield, and Air Content (Gravimetric) for Concrete (ASTM C-138) for unit weight.
  9. Report temperature of concrete at the time of placing on a regular and frequent basis.
  10. Report total water quantity added to batches, including that added after departure of concrete trucks from batch plant.
  11. Report all test results to the Architect/Engineer and the Contractor on the same day that test results are made.

### 3.4 AUTHORITY AND DUTIES OF TESTING AGENCY

- A. Technicians representing the testing agency shall inspect the materials and the manufacture of concrete and shall report their findings to the Architect/Engineer and the Contractor. When it appears that the material or work performed by the Contractor fails to fulfill specification requirements, the technician shall direct the attention of the Architect/Engineer and the Contractor to such failure.
- B. The technician shall not act as foreman or perform other duties for the Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such is discovered, nor shall it obligate the Architect/Engineer for final acceptance. Technicians are not authorized to revoke, alter,

relax, enlarge, or replace any requirements of the plans and specifications, nor to approve or accept any portion of the work.

**END OF SECTION**

## SECTION 03345

### CONCRETE FINISHES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Work included

1. Concrete walks and base slabs as indicated on drawings and specified herein.

##### 1.2 RELATED SECTIONS

A. Site Cast-in-Place Concrete                      Section 03300

B. Joint Sealants    Section 07920

##### 1.3 QUALITY ASSURANCE

###### A. Testing

1. Testing shall comply with the applicable portion of Section 03300.

###### B. Job Mock-Up

1. The Contractor shall construct a mock-up sample, 6 feet by 6 feet minimum, of the concrete walk surface, and shall indicate all the typical jointing, score lines, texture and finishes, and color required in actual construction. The Contractor shall make all mock-up samples as required until acceptance by the Architect. The selected mock-up shall become a standard of workmanship and shall be matched throughout the project. The sample may be constructed as part of the project and, if approved, will be accepted as part of the work. However, should the sample fail to meet the Architect's approval, it shall be removed and reconstructed until approved.

##### 1.4 SITE CONDITIONS

###### A. Existing Conditions

1. Examine work in place on which this work is dependent. Defects which may influence satisfactory completion and performance of this work shall be corrected in accordance with the requirements of the applicable section of work prior to commencement of the work. Commencement shall be construed as work in place being acceptable for satisfying the conditions of this section.

###### B. Protection

1. Protect the work and adjacent work against damage during progress of the work.
2. Construction equipment which will damage existing or new pavement shall not be used.

## PART 2 - PRODUCTS

### 2.1 CONCRETE

- A. All concrete shall comply with applicable portions of Section 03300.
- B. Coarse aggregate shall comply with ASTM C33 Class Designation 4S except that the sum of clay lumps, friable particles and chert shall be less than 4 percent.
- C. Ingredients shall be proportioned to produce homogeneous concrete which will attain the required strength, durability, resistance to deterioration and abrasion, water tightness, appearance, and other specified properties.
- D. Minimum compressive strength shall be 3,500 psi.

### 2.2 FORMWORK

- A. All formwork shall comply with the applicable portion of Section 03100.

### 2.3 REINFORCEMENT

- A. All reinforcement shall comply with the applicable portion of Section 03200.

### 2.4 EXPANSION JOINTS

- A. All expansion joint material shall comply with the applicable portion of Section 03300.

### 2.5 CURING COMPOUND

- A. Curing compound shall comply with the applicable portion of Section 03300.

### 2.6 JOINT SEALANTS

- A. All joint sealants shall comply with Section 07920.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine subgrade which shall have walks placed for improper grade, poor compaction, or other conditions which will adversely affect execution or quality of the work.
- B. Do not place concrete until conditions are satisfactory.

### 3.2 PREPARATION

- A. Setting Forms
  - 1. Compact subgrade under forms and cut to grade so that form, when set, will be uniformly supported for its entire length.
  - 2. Firmly stake forms to the required line and grade; join forms neatly and in such a manner that joints are free from play or movement in any direction. For sidewalks, arrange forms to provide cross-slope as indicated.

3. Set forms at least one day's construction ahead of the actual placing of concrete. Supply of forms shall be sufficient to permit forms being kept in place for at least 12 hours after concrete has been placed. Clean and oil forms before each use.

B. Before Placing Concrete

1. Maintain finished subgrade in a smooth and compacted condition until concrete has been placed.
2. Ready-mix trucks or other equipment shall not operate between forms in paving lane unless job conditions will not permit operation from shoulder or outside lane.
3. If necessary to operate trucks between forms, and trucks cause rutting displacement of subgrade, provide suitable runways, re-roll or hand-tamp subgrade as required to correct ruts or other irregularities that may be caused by trucking.
4. When the mean daily temperature is less than 35 Degrees F., protect the subgrade from freezing.
5. Immediately prior to placement of concrete, test subgrade for conformity with indicated cross section by means of an approved template riding on side forms. If necessary, remove or add material as required to bring all portions of subgrade to correct elevation. Subgrade shall be thoroughly compacted and again tested with template. Concrete shall not be placed on any portion of subgrade which has not been tested for correct elevation. Clear subgrade of loose material which may have fallen upon it. Subgrade shall be damp but not saturated with water.

### 3.3 INSTALLATION

A. Placing Concrete

1. Place concrete only on a moist compacted base.
2. Deposit concrete so as to require as little rehandling as practicable. Placing shall be continuous between transverse joints or in individual sections of the work.
3. Spade concrete thoroughly along forms and expansion joints, and work carefully into corners and around reinforcement. Tamp and screed to a dense mass.
4. Vibrators may be used provided they are operated under experienced supervision and forms are constructed to withstand their action.
5. Walks shall be one-course concrete of widths and depth, and cross-sloped as indicated.
6. Place reinforcement in walks where indicated.
7. Walks shall be continuous between expansion joints. After initial placement of concrete, bring surface of concrete to proper section guided by forms.
8. Finish surface of walks and steps to grade and cross section by floating. After floating, trowel the surface smooth and edge all edges and joints.

B. Expansion Joints

1. For unsealed joints, the expansion joint filler strip shall be installed 1/8-inch below the finish surface of the walk.

2. For sealed joints, expansion joint filler strips shall be installed in manner to provide a void having depth equal to width of joint plus 1/8-inch for sealing compound.
3. Provide 1/2-inch thick expansion joints at all points of contact with fixed objects, such as walls, buildings, curbs, pavement, poles, signs and hydrants, at intervals not exceeding 30 feet, or as indicated.

C. Control Joints

1. Provide control joints in concrete walks to form panels of sizes indicated. Control joints shall be at right angles to, and parallel to, building lines, or to patterns indicated on drawings.
2. Control joints in walks shall be 3/16-inch wide by approximately one-fifth the depth of walk.
3. Form control joints in walks by tooling or by inserting a pre-molded or metal strip finished flush with surface when concrete is placed. After the concrete has cured for a period of not less than one week, remove inserts and clean joints. Joints may be formed by sawing as soon as the concrete has hardened sufficiently to prevent raveling of the concrete at edges.

3.4 CONCRETE FINISHES

A. Broom Finish

1. Perform finishing in continuous operation, utilizing same crew to maintain continuity of finish on each surface or area of work.
2. Provide light broom finish of uniform texture consistent with approved field sample panel.
3. Provide medium broom finish of uniform texture consistent with approved field sample panel.
4. Locations: Where indicated.

B. Form Finish

1. Provide form finish on exposed concrete of cast in place concrete walls. Set form ties in uniform grid pattern. Do not fill form tie holes.

C. Sandblasted Finish

1. Perform sandblast finishing in continuous operation, utilizing same crew to maintain continuity of finish on each surface or area of work.
2. Sandblast to provide uniform texture consistent with approved field sample panel.
3. Use abrasive aggregate of proper type and gradation as required to expose aggregate and surrounding matrix.
4. Provide brush cut to remove cement matrix and expose fine aggregate with no coarse aggregate revealed.
5. Provide light cut to expose fine aggregate with occasional exposure of coarse aggregate; 1/16 inch deep reveal.
6. Provide medium cut to expose coarse aggregate; 1/8 inch deep reveal.

7. Provide heavy cut to expose and reveal coarse aggregate; 3/16 inch deep reveal.
8. Use special care in abrading edges and corners. Use backup boards in order to maintain uniform corner and edge lines. Determine type of nozzle, nozzle pressure and sandblasting techniques required to match Landscape Architect's requirements.
9. Locations: Where indicated.

### 3.5 CURING

- A. Liquid membrane curing compound shall be applied to cover surface completely and uniformly at a rate which will achieve the performance requirement specified in AASHTO Specification M148. Apply membrane curing compound immediately behind final finishing operation. Failure to provide complete and uniform coverage at required rate will be cause for rejection of all concrete so affected. Take special care to apply curing compound to pavement and walk edges immediately after forms have been removed.
- B. The curing shall continue until the cumulative number of hours or fractions thereof during which temperature of the air in contact with the contract is above 50 Degrees F. has totaled at least 168 hours. Rapid drying at the end of the curing period shall be prevented.

### 3.6 FIELD QUALITY CONTROL

- A. Perform compressive strength tests according to ASTM C31 and C39.
- B. Perform slump measurement according to ASTM C145.
- C. Perform air content according to ASTM C231.
- D. Rate of testing shall comply with the applicable portion of Section 03300.

### 3.7 CLEANING

- A. Concrete spilled on the pavement, structures, or ground shall be removed and the pavement or structures thoroughly cleaned before the concrete sets. Spilled concrete shall not be washed into sewers or drains. Restore the site of the work to a neat and sightly appearance, including removal of excess materials, forms, and equipment.

END OF SECTION