TABLE OF CONTENTS

END OF SECTION

PART 1 – GENERAL

1.01 EXTENT OF SECTION

A. This section contains PCSB requirements for exposed concrete finishes and slabs on grade.

B. The intent of PCSB STANDARDS is for the DESIGN PROFESSIONAL (DP) to comply with the minimum general project requirements and the specific project specifications shall be generated and provided by the DP.

1.02 CONTRACT DRAWINGS

A. Contract drawings show dimensions and forms of concrete and sizes and arrangements of reinforcing. Additional details will be furnished by DP where necessary to fully explain work required. In case of direct conflict between drawings and schedules in size and shape of concrete members or in size and number of reinforcing bars, schedules govern. For purpose of submitting bid price, structural sheets take precedence over architectural sheets with regard to concrete foundations, walls, columns, slabs, beams, and dimensions of structural features. In case of any conflict between structural and architectural drawings, bring conflict to attention of DP, who will issue instructions as to required revisions.

1.03 INTERIOR FINSHES

A. Exposed concrete used as an interior finish material shall be formed and finished to tolerances and finish requirements that are appropriate for the occupied space. Tolerances and finish requirements shall be indicated in the contract documents.

B. Horizontal finish tolerances may be specified using F-numbers (floor flatness (Ff) and floor levelness (Fl)) defined by ACI 117 and ASTM E-1155.

1.04 EXTERIOR FINISHES

A. ARCHITECTURAL PRECAST CONCRETE: Tolerances and finish requirements for architectural precast concrete panels shall be indicted in the contract documents.

B. CAST STONE: See Section 04000 "Cast Stone".

C. EXPOSED STRUCTURAL CONCRETE: PCSB discourages the use of exposed structural concrete columns, beams, joists, and slab soffits in public areas exposed to view.

D. EXPOSED CONCRETE AT STAIRS: Exposed concrete at stairs should have chamfered edges no greater than ½-inch. See also Section 05000 – Metals 1.03.A. STAIR NOSINGS.

E. EXTERIOR CONCRETE SLABS ON GRADE AND STAIRS: Exposed concrete traffic surfaces shall have a slip resistant broom finish. Batch colored concrete on exterior slabs is prohibited.

1.05 FIELD MEASUREMENTS AND COORDINATION

A. Verify all field dimensions to insure close fit with work of adjoining trades.

B. Coordinate and install work in proper sequence with overall job and in cooperation with other related trades; particularly with bearing concrete masonry work.

C. Assist other trades in setting their materials to be cast in concrete. Protect these items after setting. Insure they are not moved during concrete placement.

1.06 CONCRETE MIX

A. Concrete must meet all requirements of ASTM C94 and those herein specified for materials, proportioning mixing and other details of manufacturer, quality and delivery.

B. Mix Design: all mix designs shall be proportioned in accordance with 1.05 of this section. Each class of concrete shall be furnished in accordance with that scheduled in PART 2, 2.03.A of this section.

C. The concrete design mix (es) of all concrete to be used during construction of the project shall be submitted to the DP for approval prior to the placement of any concrete on the job. Only concrete of approved mix design shall be used during construction. Any concrete supplied which is not of an approved design mix shall be rejected.

1.07 APPLICABLE TECHNICAL CODES AND STANDARDS; Fabricators and CONTRACTORS are to abide by these codes:

A. Florida Building Code requirements for reinforced concrete (ACI-318/Latest Edition).

1.08 WEATHER CONSIDERATIONS

A. COLD WEATHER REQUIREMENTS: Insure that all concrete materials and all reinforcement, forms, fillers, and ground with which concrete is to come in contact are free from frost. Whenever temperature of surrounding air is below 40 degrees. F. all concrete placed in forms is to have a temperature of between 70 and 80 degrees F. and adequate means provided for maintaining temperature of not less than 70 degrees. F. for three days or 50 degrees. F. for seven days or for as much more time as is necessary to insure proper curing of concrete. Housing, covering or other protection used in connection with curing is to remain in place and intact at least 24 hours after artificial heating is discontinued. Use no salt or other chemicals for the prevention of freezing. No concrete shall be placed if it is 90° or higher or after 90 minute from the time the batch water is added.

B. HOT WEATHER PLACEMENT: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees. F (32 degrees. C). Mixing water may be chilled or chopped ice may be used to control temperature (at no cost to the OWNER), 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 reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to DP.

1.09 TESTING

A. **QUALITY ASSURANCE:** Tests shall be performed by an Independent Laboratory under Contract to OWNER. For **tests which indicate failure, that test and all costs incurred as a result thereof shall be paid by the CONTRACTOR.** Standard Slump Tests will be made when 20 or more cubic yards of concrete are placed. And not less than one such test should be made for each 20 cubic yards of concrete placed at one operation.

B. Prism testing is prohibited.

C. Cylinder Failures: If laboratory test cylinders fail to meet minimum strength required by these specifications, the DP has the right to order such changes in mix and water-cement ratio as he deems necessary to secure strength required. If job-cylinders fail to show minimum strengths required by these conditions, the DP may require such changes of conditions and/or curing as will satisfy the conditions met that concrete in job will be of proper strength. Changes of conditions may include removal and replacement of concrete in question and retesting, all at no cost to OWNER.

D. Load Tests: DP also has right to order load or core tests at no cost to OWNER on any portion of structure where test cylinders fail to show minimum strengths required. Changes of conditions referred to above may include removal and replacement of concrete in question, at no cost to OWNER. If members or portions of structure show evident failure, such changes or modifications as are necessary to make structure adequate for rated capacity shall be made by CONTRACTORS as determined by DP. This may result in removal of and rebuilding of such portions of building by CONTRACTOR without cost to OWNER. Structure shall be considered to have failed to pass test if with 24 hours after removal of test load, the slabs, beams, etc., do not show a recovery of at least 75% of maximum deflection shown during 24 hours while under load.

1. CONCRETE MIX DESIGNS: Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

Class of Concrete Compressive Strength at 28 days PSI (minimum)	Size of Aggregate in Normal Concrete	Water to Cement Ratio (maximum)	Slump (±1")
Floor Slabs & Misc. 3000 PSI for 4" slab	3/4" (min.)	.50	4"
Footings 3,000 PSI	3/4" (min.)	.55	4"
Columns & Beams and Elevated Slabs 4,000 PSI	3/8" (max.)	.48	4"
Concrete Block Grout (Chatt) 3,000 PSI	3/8" (max.)	.58	9-10"
Fiber Reinforced Concrete Ext. Sidewalks/ Covered Walks 3,000 PSI	3/8" (max.)	.55	4"

(All tests shall be taken at point of placement.)

2. Concrete shall achieve a minimum compressive strength as shown above in 28 days.
3. Maximum allowable entrapped air shall be 2% by volume. Maximum allowable air entraining admixtures shall be 3% by volume. Maximum allowable total air content shall be 5% by volume.

PART 2 – PRODUCTS

2.01 APPURTENANCES

A. All control and expansion joints shall be indicated on DP's Design and Construction Documents as listed below:
   1. Expansion or cut control joints shall not exceed a length to width ratio of 1.5 to 1 and spacing should be 24 to 36 times the thickness of the slab, limited to 15-ft. o.c. max.
   2. Control/Expansion joints in concrete shall be provided at the following locations:
      a. At major changes in wall heights;
      b. At changes in wall thickness;
      c. Where concrete walk abuts an exterior wall.
   3. Isolation joints, e.g. zip strip, with sealant are required along slabs poured adjacent to buildings.

B. DP shall specify cement, aggregates, water and all necessary accessories such as inserts, slots, vapor barriers, curing compounds, expansion control materials and joint fillers.

C. DP shall indicate proper allowances for setting beds for ceramic tile.

D. Always slope exterior walks away from the building a minimum of ¼-inch per ft. and field verify compliance.

E. Covered walks between buildings always slope to drain to the exterior and away from the building.

2.02 CONCRETE MATERIALS

A. CEMENTITIOUS MATERIAL: Use the following cementitious materials, of the *same type*, brand and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II.
      a. Fly Ash: ASTM C 618, Class F (Maximum of 20 percent of the total cementitious materials).
      b. Ground Granulated Blast-Furnace Slag is prohibited.

B. COARSE AGGREGATE FOR CAST-IN-PLACE CONCRETE: Conform to ASTM C-33 (¾-inch max. size) latest edition, "Standard Specification for Concrete Aggregates".
   1. Use ⅜-inch to ½-inch smooth brown river rock aggregate for concrete placed at curb cuts and side flares in exterior walkways.

C. AGGREGATE FOR PRECAST STRUCTURAL CONCRETE: ASTM C33 or C330.Fine Aggregate: Conform to ASTM C-33 latest edition, "Standard Specification for Concrete Aggregates". Free of materials with deleterious reactivity to alkali in cement.

D. WATER: ASTM C 94/C 94M and potable.

E. CHEMICAL ADMIXTURES: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   3. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

   Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2.03 STEEL

A. Domestic steel shall be used (no foreign steel shall be used.); also Fiber Wire Fabric (WWF) may be install but if used must provide engineered specifications.

B. REINFORCING MESH: required at typical installations; where noted on drawings, conform to ASTM A-185 latest edition, “Welded Wire Fabric for Concrete Reinforcement”. See architectural and structural drawings.
   1. TYPICAL LOCATIONS:
      a. Sidewalks - see Section 02700 for sidewalks and covered walks.
      b. Play Courts shall be 60-ft. by 90-ft. and shall utilize 6-inches thick fiber mesh reinforced 3000 PSI concrete. Provide 6-ft., 1-inch radius around basketball

support columns. Play courts shall have a thickened edge, see also Section 02700.

C. Areas of heavy traffic e.g. pedestrian and golf carts, covered sidewalks or floor slabs inside buildings shall be reinforced with welded wire fabric (WWF) where slab size, thickness and layout shall be as detailed in DP's Design and Construction Documents.

D. REINFORCING BARS: Conform to ASTM A615-68 (Grade 60, Fy = 60,000 PSI), domestically produced. Bars to be free from flaws, cracks or other defects of rolling, true to size and shape, and free of loose scales of rust. A thin coating of firmly attached rust is not cause of rejection. Bars to be free from dirt, paint, grease, oil or other destroyers of bond. Reinforcing steel should be free of kinks and not-shop bends. Field bends should only be as directed by the DP.
   1. Synthetic Fiber Reinforcing: Concrete Engineered Reinforcing Fibers shall be polypropylene, collated, fibrillated fibers by Fibermesh, Inc., Chattanooga, TN, CFP Fiber by Forta Corp, or approved equal. Only fibers designed and manufactured specifically for use in concrete from virgin polypropylene and so certified by manufacturer shall be acceptable. Fiber length shall be ¾". Use at the rate of 1 ½ pounds per cubic yard.
   2. **Reinforced concrete with synthetic fiber may be used only on exterior concrete slabs beyond building overhangs, covered walks and sidewalks, unless otherwise approved by the OWNER and DP. Use of fiber reinforced concrete shall be in accordance with Section 02700.**

E. Steel Plates, Inserts and Fasteners: Conform to ASTM A-7 latest edition, "Steel for Bridges and Buildings".

F. Structural Steel: Conform to ASTM A-36, A-572, or as noted, latest edition.

G. ACCESSORY SUPPORTS: Use formed steel wire manufactured items, plastic tipped for all exposed concrete work. Concrete bricks may be used to support bottom bars in earth beams. Provide chairs at reinforcing placed over metal deck.

2.04 FORMWORK

A. FOOTINGS: Use fabricated formwork for all work. **Earth forms *will not be allowed*.**

B. FORMWORK, GENERAL: Conform to shape, lines and dimensions of members as called for on plans. Forms for concrete to be concealed may be plywood or dressed lumber. Build all forms substantially and sufficiently tight to prevent leakage. Properly brace or tie together to maintain position and shape. Provide feature strips between concrete and masonry where exposed to view. Provide chamfers at all outside corners/edges.

2.05 MISCELLANEOUS PRODUCTS

A. VAPOR RETARDER: (All walks and slabs are to be placed over 10 mil polyethylene vapor barrier.).
   1. Vapor Retarder shall have the following qualities
      a. Water Vapor Transmission Rate, ASTM E96 / 0.04 Perms or lower
      b. Water Vapor Retarder, ASTM E1745 / Class C
      c. Thickness, ACI 302.1R-96 / *not* less than 10 mils.
   2. Lap seams 6" minimum, all joints to be taped per vapor retarder manufactures

approved material.

B. CONSTRUCTION JOINT: Use asphalt felt or polyethylene film as a bond breaker in areas calling for construction joints.

C. FLOOR HARDENER: Use fluorosilicate base liquid hardener, Sika Hardener produced by Sika Chemical Corp., Solidus liquid hardener #219-2001 produced by Lambert; Protocrete-CDS or as approved by OWNER/ DP. Apply floor hardener to floor slab surface at interior locations where such slabs are scheduled to be left exposed with no other finish.

D. Curing Compound: (Refer to PART 3.08)

PART 3 – EXECUTION

3.01 MISCELLANEOUS

A. All "CAST-IN-PLACE" concrete should be ready mixed. Specify maximum slump and minimum strength for all types of concrete used. All concrete shall be placed within 1 hour after introduction of water to the mix. Under no conditions may additional water be added. All concrete where water has been added will be removed and replaced with proper concrete at no cost to the OWNER.

B. Begin curing of concrete not more than 3 hours after placing. **Curing compound used on floors that are to receive tile or other additional finish shall be compatible with adhesives and finish materials.**

C. No concrete shall be placed until all reinforcing steel, pipes, sleeves; inserts, etc. have been set in place and inspected by the DP and AHJ. Notification of the DP and AHJ of scheduled pours 48 hours prior to pouring shall be included within DP Design and Construction Documents.

D. Any *saw-cut must be done within 24 hours of pour* as specified by NRCA.

E. During cold temperature an accelerator up to 1 percent may be added to shorten curing time.

3.02 CONCRETE PROPORTIONING

A. Insure proportions of cement, aggregate, and water in mix are such as to produce a plastic and workable mass suitable for economical and uniform placement. Make one slump test at time cylinders are made for compression tests. Concrete test reports are to include slump tests, and state where concrete was used. **Slump to not exceed that specified in Part 1-1.09.D.1**. Avoid excessive fluidity which may result in segregation of materials. Insure mix has no free water, clings to coarse aggregate and upper layer of set concrete is free from laitance.

B. Base water-concrete ratio of mix on established relationships between water-cement and strength of concrete, such as to produce required strength of concrete with least amount

of water, consistent with workability of fresh concrete. Include surface water contained on aggregate as part of mixing water in computing water content.

C. Measure moisture in aggregate by method satisfactory to DP which will result within one pound for each 100 pounds of aggregate. Moisture in aggregate shall be a portion of mixing water allowed.

D. Adjust proportion of fine to coarse aggregates to produce maximum workability. In no instance shall fine to coarse ratio vary more than ½ to 1.

E. If it is DP'S opinion that subsequent concrete is not equal to first mixes established, he shall have the right to reject the material and/or request additional laboratory tests and confirmation at CONTRACTOR'S expense.

3.03 CONCRETE MIXING

A. Order load size based on method of placement and amount of time available to place. Mix ready-mixed concrete and deliver in accord with requirement set forth in "Standard Specifications for Ready-Mixed Concrete", (ASTM designation C-94, latest edition). In addition, mix for a period of not less than 10 minutes at a peripheral drum speed of approximately 200 feet per minute. Continue mixing until discharge is completed. At least 3 minutes of mixing period to be at job site. **Concrete will be rejected if not placed in final position within 1½ hours after water is first added to batch**. Concrete at time of placing, to be in such condition that it can be properly placed.

When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

B. Addition of water to ready-mixed concrete at the jobsite is not recommended and such addition will be at the sole risk of the supplier and CONTRACTOR. Such addition shall be under direct supervision and authorization of on-site quality control representative of concrete supplier, OWNER, DP or ENGINEER reserves the right to reject any such field modified concrete, if in their opinion the quality of the concrete has been jeopardized by such modifications.

C. Concrete shall be deposited continuously so that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams of weakness within the section. If a section cannot be poured continuously (and no more than 30 minutes between pours), construction joints shall be located as indicated on the contract documents or as permitted. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic.

D. See PART 1, Section 1.09 for concrete testing in this Division.

3.04 FORMWORK, GENERAL

A. Design and engineering of formwork, as well as its construction, is responsibility of CONTRACTOR.

B. Conform to shape, lines and dimensions of concrete members as shown on drawings. Brace, tie and shore to maintain position and shape and to insure safety to workmen and passerby. Make sufficiently tight to prevent leakage. Design and construct to resist

pressure to which they are subjected without sag or displacement and assembled in such manner that their removal will not damage concrete.

C. Provide temporary clean-out openings at bottom of forms for walls, columns and deep beams to facilitate cleaning and inspection immediately prior to concrete placement. Openings to provide complete access to surface on which concrete is to be cast. Reinforcing bars in filled cells shall be sized for low lift grouting, with no more than 5'-0" lifts.

D. Edges of columns, beams, and walls **to be built with no chamfers**, unless shown otherwise on drawings.

E. Provide openings in concrete formwork to accommodate work of other trades, determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

F. Construct formwork so as to insure that concrete surfaces conform to tolerances of Section 2.05, "Recommended Practice for Concrete Formwork" (ACI 347).

3.05 STEEL, GENERAL

A. Shop Work
1. Detail to conform to procedures of ACI 315 latest edition "Manual of Standard Practice for Detailing Reinforced Concrete Structures".
2. Shop bend steel to shapes shown or scheduled on drawings, bend cold. **Field bend no steel except where specifically permitted by DP**.
3. Furnish bent steel to job, bundled and tagged to its proper location, as required by CONTRACTOR. Beam and column ties and stirrups are to be fabricated so that outside dimensions are small enough to insure that tolerances to all sides of forms are adhered to.
4. Steel to be free from loose scale, flaking rust, oil, mud and other foreign substances when placed in forms and when covered by concrete. Steel which is not clean is to be cleaned of all foreign material, or is to be removed from forms and site.

B. Field Handling and Placing
1. CONTRACTOR is responsible for accurate placement of all reinforcement. Promptly inform DP if any reinforcement does not fit into overall concrete configuration, with proper lap and/or coverage, who will consult with CONTRACTOR and issue equitable instruction for resolution.
2. Keep steel clean while placing concrete. Where any spilled concrete dries on steel, thoroughly clean steel before concrete is placed around it. Cleaning of steel may include sand blasting.
3. Place all metal reinforcement accurately, and hold in place to prevent displacement during placing of concrete. Mark location of vertical reinforcement on floor or blocks. All footing dowels or stubs shall be tied accurately in place before footing concrete is placed. Where steel as specified, scheduled or detailed does not provide top steel in areas where stirrups or web reinforcement is required, provide two #4 bars in top of member for support of stirrup or web reinforcement. Saddle ties are preferred. Use sufficient ties to maintain reinforcement in correct position. Set all column dowels and anchor bolts accurately by use of template.
4. REINFORCING STEEL COVER: 3-inches for all concrete in contact with earth: 1½-inches for all other concrete work except as shown on drawings.

5. Minimum clear spacing between parallel bars is one bar diameter. In no case shall clear spacing between bars be less than 1-inch nor less than 1⅓ times the maximum size of the coarse aggregate used. Size of coarse aggregate determined by bar spacing. See paragraphs 2.02 B and C of this Section.
6. Support all beam and slab reinforcing on chairs as previously called for. No masonry supports will be allowed. Set chairs and spacers according to specifications for placing accessories in manual of Standard Practice of the Concrete Reinforcing Steel Institute; Max. Chair spacing shall be 3-ft.
7. Tie all reinforcing steel firmly in place with not less than No. 18 wire or plastic ties.
8. Lap all bars at splices according to the ACI code requirements but not less than 48 bar diameters nor 24-inches. Bend all horizontal wall bars not less than 18-inches around corners. All column bars shall lap 48 diameters, 2-ft., 6-inches min. into column above.
9. At all inside corners a #5 x 6-ft. bar shall be placed diagonally in the slab.

3.06 CONCRETE PLACEMENT, GENERAL

A. Give DP and OWNER sufficient advance notice, two working days, before starting any concrete pour, to permit inspection of forms and soil poisoning.
   1. Scheduling of concrete pours shall allow one full working day after 100% completion of all form construction and steel placement prior to commencement of pour.
   2. The DP and OWNER'S inspector is to be notified at least one full working day prior to 100% completion of form construction and steel placement. The intent is to allow inspection as soon as possible after 100% completion and provide the CONTRACTOR with approximately one full working day to correct any discrepancies.
   3. The testing laboratory is to be notified as soon as the concrete is scheduled or one full working day in advance, whichever is sooner.
   4. Unless the CONTRACTOR is specifically notified otherwise, both the DP and the inspector will inspect prior to each pour.
   5. Pours for sidewalks and equipment pads at grade do not require testing by the laboratory or observation by the inspector or DP provided form work and reinforcing are inspected prior to the pour.
   6. **CONTRACTORS are requested to avoid scheduling any concrete pour other than those listed in item 5 above to begin later than 1:00 p.m. any day.**
   7. Under-Slab Vapor Barrier: Install a single layer polyethylene vapor barrier **typically beneath all interior and exterior slabs (and sidewalks)** on grade or fill. Lap all joints six (6) inches minimum, and turn barrier up at walls to top of slab. Tape seal all joints and laps and seal all penetrations under all enclosed building areas.
   8. Built-In Items: determine area to be poured: install and properly locate all conduits, pipes, sleeves, hangers, steel equipment, grounds, anchors, reglets, waterstops and other work required to be built into concrete work.
      a. Securely held in position prior to and while casting concrete and shall be protected from construction activity until the structure above is in place. Inserting bolts into partially hardened concrete or straightening bent over bolts is prohibited.
      b. Place dovetail slots aligned and fastened securely to formwork such that they will not be moved during placement of concrete.
   9. Cleaning of Steel and Formwork: before depositing concrete, remove all water and debris from place of deposit. Thoroughly clean any reinforcement and forms coated with foreign material, or with concrete from previous operations.
   10. Placement: deposit concrete as nearly as practicable to or not more than six 6-feet from its final position, to avoid segregation due to re-handling or flowing. Carry on at such rate that concrete is at all times plastic and flows readily into space between

bars. Deposit no concrete partially hardened or contaminated by foreign material. Use no re-tempered concrete. Carry concrete placement on as continuous operation until placing of panel or section is completed. Top surfaces are to be level. If section cannot be placed continuously locate construction joints provided for in drawings or approved by DP. Pour no concrete within (twenty-five) 25-feet of workmen placing or securing reinforcement. Free fall is not to exceed 5-feet.

11. Construction and Control Joints: locate as indicated on drawings. Make no other joints in any beams or cantilevers. Any control or construction joint required and not shown on plans will be as directed by, or require approval of DP. All control jointing in floor slabs are to be field sawn to 30 percent of slab thickness as soon as workmen can work on slab and cutting operation will not damage finish or spall cut edges, and must be cut on same day of pour, maximum 10 hours after placement. Maximum joint spacing is 12'-0" each way, unless shown otherwise on drawings.
12. Control joints in all exterior slabs, walks, etc., are to be saw-cut. Cuts shall be straight and true with a deviation tolerance of ½-inch 20-feet. Depth of saw-cut shall be a minimum of $^{3}/_{8}$-inch or as detailed on structural drawings. Tooled joints may be used as shown on drawings and as approved by the OWNER.
13. Construction Joints: install bond breaker where noted on plans. If joint material is necessary (and only as approved by DP), match profile section of adjoining concrete members and do not use material more than $^{1}/_{4}$-inch thick.
14. Apply temporary protective cover to finish surfaces while placing concrete to guard against spattering.
15. Comply with ACI 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

3.07 COMPACTING CONCRETE, GENERAL

A. Deposit concrete in horizontal layers not over 12-inches in depth and thoroughly work and compact by spading, rodding, or mechanical vibration into all parts of forms, until air pockets are worked out. Compact to insure dense, smooth concrete surfaces, the thorough filling of forms without voids or pockets, and embedment of all reinforcing and inserts, taking care to avoid vertical joints or inclined planes. Piling up of concrete in forms in such a manner as to permit escape of mortar or flow of concrete itself is not permitted.

B. Vibrate by means of mechanical internal type concrete vibrators operating at not less than 5,000 pulsations per minute. Use at least one such vibrator for each 25 cubic yards of concrete being placed per hour. Hold vibrators in one position only until concrete has become plastic and has filled all holes or spaces but not long enough to create a pool of mortar. Do not hold vibrators against reinforcing steel, inserts or forms, but move about through mass of concrete itself until concrete has leveled out to fill thoroughly against forms and embedded steel and inserts.

C. Externally vibrate thin walls and inaccessible sections by manual or mechanical means.

D. Do not use mechanical vibrators as means of transporting concrete and not to move concrete horizontally in forms. Trucking, walking or handling of heavy materials over freshly placed concrete is prohibited.

E. Reverberation of concrete is not permitted.

F. The CONTRACTOR shall have a standby vibrator on hand in case of failure.

3.08 REPAIR AND PATCHING, GENERAL

A. Any concrete which is not formed as shown on plans, or for any reason is out of alignment or level or shows a defective surface is hereby considered as not conforming with intent to these specifications. Remove from job by CONTRACTOR at his expense and replace with concrete meeting these specifications at CONTRACTOR'S expense.

B. Where damage or imperfection is minor, DP/ OWNER may permit repair or patching. In latter case, immediately after removing forms, inspect all concrete surfaces, interior and exterior. Patch all honeycombs, voids, stone pockets and holes at once, before concrete is thoroughly dry. Chip away defective areas to depth of not less than 1-inch, with edges perpendicular to surface. Wet areas to be patched and a space at least 6-inches wide entirely surrounding it, to prevent absorption of water from patching mortar. Apply compatible bonding agent and allow to dry. Use patching material of same proportions as used for concrete, except omit coarse aggregate.

3.09 CURING AND PROTECTION

A. General: protect all freshly placed concrete from elements and from damage or defacement due to building operations, or passerby.

B. Top Surfaces: as soon as concrete has hardened sufficiently to prevent damage to it cover top surface with one of the following materials:
   1. A vapor barrier such as sisal kraft paper or polyethylene plastic.
   2. A liquid curing compound such as "Cure Seal" by Concrete Service Co., Sonosil (curing), or as approved, free from oil, paraffin, silicone, grease, or wax. The coating is to retain 95% of original mixing water after 7 days when tested in accordance with ASTM 156-40T. Apply at the rate of one gallon per 200 sq. ft. The coating is in no way to adversely affect subsequent painting, application of hardener, or flooring adhesive. If sand or a vapor barrier is used, keep continually wet by sprinkling with water for at least 7 days.
   3. Apply floor hardener on interior slabs scheduled to be left exposed with no other scheduled finish.

C. Other Surfaces: leave forms in place and keep wet for as long as possible to aid in curing. As soon as they are removed, cure bottoms, tops and sides of all concrete surfaces by coating with an application of liquid curing compound as specified above.

3.10 WORK COORDINATION BETWEEN GENERAL CONTRACTOR AND DIVISION 15 & 16

A. It is intended that the general CONTRACTOR will be responsible for providing and installing all concrete work including mechanical and electrical equipment bases, inertia blocks, gravity pads and the like, except as noted in paragraph 3.10.B hereinafter.

   Unless specifically dimensioned or described in the plans and/or specifications, sizes of these items are to be verified and carefully coordinated with the trades providing and installing the equipment. Anchoring and fastening devices for the equipment are to be provided by the trades supplying such equipment and jointly set into the concrete work to assure accurate placement. Any necessary modifications to such concrete work caused by approved alternative equipment will be the joint responsibility of the general CONTRACTOR and related subcontractor as approved by the DP and at no additional cost to the OWNER.

B. Concrete work for outside underground utility trades is assumed to be provided and installed by those respective trades where this work will be fully concealed. (Examples are manholes, grease traps and septic tanks, duct banks, underground storage tank anchor pads, thrust blocks and the like.)

C. Backfilling and compaction of all disturbed areas caused by these trades utility line installations under slabs and footings and beyond building lines shall conform to Division 2 requirements and shall be the responsibility of the trade involved as designated by the CONTRACTOR.

END OF SECTION

PART 1 – GENERAL

1.01 EXTENT OF SECTION

A. This section contains PCSB requirements for exposed concrete finishes and slabs on grade.

B. The intent of the PCSB STANDARDS is for the DESIGN PROFESSIONAL (DP) to comply with the minimum general project requirements and the specific project specifications shall be generated and provided by the DP.

C. RELATED DOCUMENTS: Conform to Division 1, Section 03000 and other sections of this division.

PART 2 – PRODUCTS

2.01 All concrete shall develop a minimum ultimate strength of design mix in 28 days. This refers to concrete on the job, in the forms, at its final designated position.

PART 3 – EXECUTION

3.01 CONCRETE PROPORTIONING

A. Refer to Section 03000/ Concrete, General.

3.02 CONCRETE MIXING

A. Refer to Section 03000/ Concrete, General.

3.03 FORMWORK

A. General
   1. Refer to Section 03000/ Concrete, General.
   2. See drawings for configuration of cast-in-place concrete and provide exterior construction forms to produce this configuration.

B. Foundations and Footings:
   1. Forming: all footings are to be formed to size shown on drawings. ***EARTH FORMS SHALL NOT BE ALLOWED.***
   2. Filling under Footings: should excavations be carried to uneven levels or deeper than called for, the CONTRACTOR shall fill same with concrete.
   3. Footings Less Than Shown: if excavations have been ordered held at less depth than shown, give OWNER a credit for concrete and excavation saved.
   4. Openings for Pipes: leave openings for all pipes, drains, etc., where shown or required. Later, caulk pipes in place at wall penetrations and grout slab penetrations.
   5. Water in Footings: no standing water is permitted in excavations for footings when the concrete is placed. Keep water from excavation until concrete has attained initial set.

C. Form Construction
   1. Set form lumber horizontal or vertical as conditions require. Lumber and plywood once used in forms to have loose nails withdrawn, and surfaces in contact with concrete to be thoroughly cleaned before reuse.
   2. Before concrete is placed, thoroughly wet inside of forms (and earth at bottom of footings) with water, or coat with non-staining mineral oil or other material approved by DP. Where any coating other than water is used, apply before reinforcement is placed.
   3. Trade's Inserts Set into Formwork: assist other trades to install their work, as Section 03000/Concrete, General. If placing of inserts disrupts proper placement, endangers shear or bearing areas, or otherwise impairs structural members, consult DP for instructions.

D. Form Removal
   1. Remove all forms and shoring completely and cut off or remove all form ties. Plug all holes resulting from form ties with appropriate matching manufactured plugs.
   2. Have competent foreman in charge of form removal and do work in such manner that new concrete is not damaged by such removal or by dropping of heavy pieces of forms. Remove formwork not supporting weight of concrete, such as sides of beams, wall, columns and similar parts of work not less than 24 hours after placing concrete.
   3. CONTRACTOR is fully responsible for removal of forms, but DP's or OWNER'S inspector has right to prohibit removal of any form or shoring when he considers it unsafe. In no case shall supporting forms or shoring be removed until members have acquired sufficient strength to safely support their weight and load thereon.
   4. Removal of forms for beam soffits is prohibited unless concrete is 7 days old, has been properly cured, and is back shored for 14 additional days with minimum of 3 shores per span of beam and/or girder. At the CONTRACTOR'S option, he may pay for and obtain a cylinder to show the concrete meets the design strength after the 7 day period.
   5. Removal of forms of beam soffits is prohibited unless concrete, as evidenced by compressive tests, has gained 75% of specified strength. Place back shores as specified above.
   6. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of concrete may be removed after 3 days, if concrete has hardened sufficiently to resist damage from removal operations, particularly when form ties will be bent by removal operations.
   7. If no loads, construction or otherwise, are superimposed until after concrete gains its specified strength, back shoring may be omitted.
   8. Should loads greater than design loads be superimposed, back shoring is required which is sufficient to carry superimposed loads.
   9. All footing or other forms installed below grade are to be fully removed and form areas properly backfilled and compacted. Any wood grade stakes are to be removed.

3.04 STEEL HANDLING AND PLACING

A. Refer to Section 03000/ Concrete, General.

3.05 POLYETHYLENE VAPOR/MOISTURE BARRIER

A. Install over compacted fill as outlined in Section 03000/ Concrete, General. Place immediately after completion of soil poisoning, and not more than 2 hours thereafter under all floor slabs on earth.

3.06 CONSTRUCTION JOINTS

A. Locate construction joints where anticipated stresses are low.

B. Before placing new material against the completed side of the joint, clean the joint thoroughly and specify a bonding agent, mortar, lean grout, etc., as required to meet the definition and function of a construction joint.

C. Structural reinforcing shall be 100% continuous across the joint.

D. Where applicable, waterstops shall be provided for watertightness.

E. General: make construction joints where shown on drawings. Where not shown or specified, place at points so as to least impair strength and appearance of structure. For floor slab construction joints, form edge true and level. Install smooth dowels through form as indicated, to control differential slab displacement between adjacent pours. DP requires CONTRACTOR to jointly consult on placement, prior to concrete pours.

F. Integral Pours: pour all beams in one pour with no joints, terminating only at a planned and approved control joint.

G. Bonding Fresh and Hardened Cement: retighten forms before depositing fresh concrete on or against concrete which has set. Roughen surface of set concrete: clean of foreign matter and laitance thoroughly and place new concrete. Provisions of this article do not apply to joints designated as expansion and/or control joints at which locations no bond of old to new concrete is to be made.

3.07 CONTROL/EXPANSION JOINTS

A. Control/Expansion joints in concrete shall be installed according to one of the following methods:
   1. Refer to Section 03000/ Concrete, General for additional requirements.
   2. Pre-manufactured joint filler cast-in-place. The joint filler shall be closed cell polyethylene foam construction "zip form" with easy tear off strip to create reveal for sealant. Refer to Section 07900/ Sealants, Caulking, and Seals.
   3. Saw-cutting. To be effective, saw-cutting must occur as soon as possible after concrete placement. Many factors influence the timing of saw-cutting, including weather conditions, concrete mix design, curing, and time of placement. However, the following general guidelines shall apply:
      a. Hot/dry conditions. Saw-cut within 4 - 12 hours.
      b. Cool moist conditions. Saw-cut within 24 hours.

B. Control/Expansion joints in concrete shall be provided at the following locations:
   1. At major changes in wall heights.
   2. At changes in wall thickness.
   3. Where concrete walk abuts an exterior wall.

C. Locate control/expansion joints to accommodate anticipated contraction, usually at a set spacing of between 15 - 30 feet.

D. The spacing of joints is contingent on the material’s capacity to sustain expansion without damage to the concrete or masonry (usually based on the amount of reinforcing).

E. Maximum structural reinforcing shall be 50% continuous across the joint. Terminate non-continuous reinforcing a minimum of two (2)-Inches from the faces of the joint.

F. Smooth reinforcing dowels properly detailed can be provided to prevent movement out of the plane of the vertical surface and for shear transfer across the joint if the normal reinforcing detailed is not adequate.

G. The minimum control joint depth shall be $^3/_4$ - 1 inch. Refer to Section 03000/ Concrete, General.

H. Control joints shall be sealed or as detailed in Architectural/Engineering drawings.

I. Where applicable, waterstops shall be provided for watertightness.

3.08 CONCRETE PLACING

A. Refer to Section 03000/Concrete, General.

B. Cooperate with (OWNER'S) concrete testing laboratory during the concrete testing. Before beginning any concrete operation, proposed unit of pour is to be approved by DP/ OWNER, and entire unit is to be completed during concrete operation.

C. Preparation: Place no concrete until steel has been inspected and approved by DP/ OWNER. Clean all forms free from shavings and other debris before placing concrete. Place no concrete until cleaning of forms has been inspected and approved by DP. Prior to pour, insure that other trades' work set into concrete is accurately placed, and secured against movement during pour.

D. Interior Floor Slabs:
1. Refer to this Section Part 3 - 3.07 for Control/Expansion Joints.
2. Screed all floor slabs carefully and accurately to level, or to slopes and grades shown on drawings. Form all depressed slabs as shown on drawings. Locate so wall dimensions shown on architectural drawings will conform to edges of depression. Form all ridges and valleys to smooth plane and straight line. Curbs may be formed with slab pour if CONTRACTOR can conform to curb shape.
3. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

a. **DEPRESSION**	**RADIUS OF AREA DRAINED**
$^1/_2$"	5' - 0"
$^3/_4$"	10' - 0"
0"	15' - 0"
1 -$^1/_4$"	20' - 0"
1 -$^1/_2$"	25' - 0"

E. Concrete Columns, Lintels and Bond Beams Poured Into/Onto Masonry:
1. Insure all masonry work is complete, with all vertical and horizontal reinforcement properly extended into concrete space, and masonry cured sufficiently to bear stress of concrete pour without cracking of any masonry joints.
2. Noticeably cracked masonry joints adjoining concrete, either before or after pour, is cause for CONTRACTOR to replace work, if so directed in writing by DP.
3. Take care to remove all evidences of pour from surrounding masonry walls and concrete floors.
4. Take extreme care during form removal not to spall or otherwise damage any work exposed as either interior or exterior finish.

F. Refer to Section 03000/Concrete, General for compacting requirements.

G. Refer to Section 03000 Part 3 - 3.08 Repair and Patching, General. Insure all exposed patches conform to appearance of adjacent unpatched work, as approved by DP.

H. Where Welded Wire fabric is used, castle supports at 3'-0" O.C. minimum shall be provided.

3.09 CONCRETE FINISHING

A. Screed topping and concrete to true level surface, with strike board, and work with wooden floats to thoroughly compact surface. Avoid such working as will bring water and fine particles to surface. Do no dusting of surface with cement or other material. Power floats permit use of stiffer mixes, produce better results, and are preferred. Surface grinding is required, in event rain causes damage to any floor finish. Refer to Section 09000/Finishes, General/Legend, to verify extent and locations of various finished concrete surfaces in building.

B. FLOORS
1. *Slabs Covered with Resilient Tile and Carpet Flooring:* screed top surface of concrete to *true level*. Finish with steel trowel. Troweling is to be sufficient to smooth surface without making it slick. All trowel marks shall be erased and surface left level and true to horizontal plane, free of waves, humps, depressions and other irregularities.

2. *Slabs after placement and finishing* are to produce a uniformly true level surface which does not exceed $^1/_8$" variation up or down in any 10 foot direction when tested with a straight edge or by instruments and the $^1/_8$" allowable tolerance up and down shall not both occur in a single 10'-0" distance. In addition, a maximum deviation of $^1/_4$" (up or down) from true level shall be allowed across any single building area.

   Slabs found to exceed the level tolerance of $^1/_8$" in 10'-0" are to have high spots ground down and low spots filled with an approved leveling compound. If in the opinion of the DP tolerances are not met satisfactorily and that grinding and filling produce an unacceptable surface, the slab in question is to be removed and replaced properly, at no additional cost to the OWNER.

3. *Exposed Slabs* finish to smooth uniform surface. Use light broom for all exterior surfaces, and smooth steel trowel finish for all interior surfaces. Fill all depressions and grind all fins or irregular surfaces.

4. *Depressed Slabs* receiving Ceramic or Quarry Tile Finish: lightly scarify to bond to Portland cement setting bed.

END OF SECTION