CONCRETE CONSTRUCTION SPECIFICATION

REVISION	DATE	DESCRIPTION	BY	REVIEWER
0	12/09/2009	ISSUED FOR CONSTRUCTION	MJS	TDJ

SECTION 1 – CAST-IN-PLACE CONCRETE

1.1 GENERAL. This section covers cast-in-place concrete and includes reinforcing steel, forms, finishing, curing, and other appurtenant work.

1.2 MATERIALS. Materials shall be in accordance with the following requirements.

Acceptable products and manufacturers are listed with the materials below. Products of equal or better quality from other manufacturers may be used if approved by FPL. Where products and manufacturers are not listed for the materials below, the Contractor shall submit product information for approval to FPL prior to using the materials:

Item	**Material Required**
Cement	ASTM C150, Type I or II.
Fly Ash	ASTM C618, Class F, except loss on ignition shall not exceed 4 percent for Class F
Fine Aggregate Clean Natural Sand	Clean natural sand, ASTM C33 including Appendix XI. Manufactured sand will not be acceptable
Coarse Aggregate	Crushed stone, washed gravel, or other acceptable inert granular material conforming to ASTM C33 including Appendix XI, Class Designation 4S.
Water	Potable and free from deleterious substances. Iron shall not exceed 0.25 ppm.
Admixtures	
Superplasticizer	ASTM C494, Type F, extended slump life type
Plasticizer	ASTM C494, Type A
Grace	"WRDAHC"
Master Builders	"Pozzolith 997"
Protex	"PROCRETE N"
Sika Chemical	"Platocrete 161"
Cormix	"PSI-N"
Plasticizing Retarder	**ASTM C494, Type D**
Grace	"Daratard 17"
Master Builders	"Pozzolith 300R"
Protex	"Procrete R"
Sika Chemical	"Plastocrete 161R"
Cormix	"PSI-Retarder"
Reinforcing Steel	
Bars Not Otherwise Noted	ASTM A615, Grade 60. Yield strength shall be determined by full size bar tests.
Bar supports	CRSI Class 3 where in contact with formed surfaces that will not be exposed. CRSI Class 1 plastic protected for use in contact with forms for exposed surfaces.
Welded Wire Fabric	ASTM A185
Flexible Water Stops	**PVC ribbed or serrated, 6 inches by 3/8 inch, with "O" bulb closed center sections unless otherwise indicated on the drawings.**
Greenstreak	"Greenstreak 732"
W. R. Meadows	"Sealtight Type 6380"
Vinylex	"RB6-38"

Item	**Material Required**
Hydrophilic Water Stops	**Installed with hydrophilic caulk in accordance with manufacturer written instructions.**
Cetco	"Akwastop"
Form Coating	
Nox-Crete	"Nox-Crete Form Coating"
L&M	"Debond"
Protex	"Pro-Cote."
Richmond	"Rich Cote"
Polyethylene Film	**Fed Spec L-P-378D, Type I; 6 mil**
Expansion joint materials	
Primer	As recommended by sealant manufacturer.
Filler	Preformed, ASTM D1752, Type I (sponge rubber) or closed cell plastic foam (PVC or polyethylene)
W.R. Grace	"Rodofoam" Grade 300
Urethane Sealant (self-leveling)	Two component, Fed Spec TT-S-00227E, Type 1, Class A; gray color
Pecora	"NR-200 Urexpan"
Tremco	"TCH-900"
Epoxy Bonding Compound	
Sika Chemical	"Sikadur 32 Hi-Mod"
Membrane Curing Compound and Floor Sealer	**ASTM C1315, Type I, Class B except that it shall have a minimum 24 percent solids, shall be nonyellowing, and shall have a maximum unit moisture loss of 0.040 g/sq cm**
Cormix	"Sealco 800"
ProSoCo	"Kure and Seal"
Master Builders	"Cure-N-Seal 30"
Sonneborn	"Kure-N-Seal 800"
L&M	"Dress & Seal 30"

1.3 PRELIMINARY REVIEW. The source and quality of concrete materials and the concrete proportions proposed for the work shall be approved before starting concrete work. Complete certified reports covering the materials and proportions for each concrete class shall be prepared by an independent testing laboratory.

1.3.1 Materials. Reports on cement and fly ash shall include the type, brand, manufacturer, composition, and method of handling (sack or bulk).

Reports on admixtures shall include the ASTM C494 classification, brand, manufacturer, and active chemical ingredients. All admixtures used shall be from one manufacturer.

Reports on aggregates shall include the source, type, gradation, deleterious substances, soundness, abrasion loss (coarse aggregate), and the results of all tests required to verify compliance with ASTM C33 including Appendix XI.

1.3.2 Proportions. A tentative concrete mix shall be designed and tested in accordance with ACI 318 for each size and gradation of aggregates and for each mix class. Design quantities and test results of each mix shall be submitted for acceptance. Slump shall be within 3/4 inch of the specified slump.

The report for each proposed concrete mix shall be provided on the attached EXHIBIT A – CONCRETE MIX DESIGN SUBMITTAL FORM.

1.3.3 Testing. Aggregates shall be sampled and tested in accordance with ASTM C33, including Appendix XI. Aggregate soundness may be determined by either the sodium sulfate or magnesium sulfate test. The bulk specific gravity of each aggregate shall be determined in accordance with ASTM C127 and ASTM C128.

Two sets of three compression test cylinders shall be made from each proposed concrete mix. One set of cylinders shall be tested at an age of 7 days, and the other set shall be tested at an age of 28 days. Concrete test specimens shall be made, cured, and stored in accordance with ASTM C192 and tested in conformity with ASTM C39.

Slump shall be determined in accordance with ASTM C143.

Tests for initial set shall be made at ambient temperatures of 70° F and 90° F. The test at 70° F shall be made using concrete containing plasticizing admixtures. The test at 90° F shall be made using concrete containing plasticizing retarder admixtures. Initial set shall be determined in accordance with ASTM C403.

All testing costs are by Contractor.

1.4 CONCRETE CLASSES

MIX CLASS TABLE					
Mix Class	**Usage**	**Strength* (psi)**	**Coarse Aggregate Size, No. 4 Sieve to**	**Max Slump****	**Max Water/ Cement Ratio*****
A-1	Lean work slabs, fill	2,000	1"	6"	0.75
A-2	Duct banks	2,000	3/4"	6"	0.72
B-1	General usage	4,000	1"	5"	0.50
B-2	Piers	4,000	3/4"	7"	0.47
C-1	Cooling towers, basins, pump structures, as noted on the drawings	5,000	1"	4"	0.40

* The strength is the minimum 28 day compressive strength for concrete using Types I, II, and III cement. The strength is the minimum 45 day compressive strength for concrete using Type V cement.
** The slump in the table is the maximum slump at the point of concrete discharge prior to addition of superplasticizer. The maximum slump at the point of concrete discharge after addition of superplasticizer shall be the slump listed in the table plus 3 inches.
*** If fly ash is used in the concrete mix, this shall be the water/(cement and fly ash) ratio.

1.5 MIX REQUIREMENTS. Each concrete mix shall be designed and controlled within the limits specified in the SECTION 1.4 - CONCRETE CLASSES.

The acceptability of concrete will be judged on compliance with all of the specified requirements and not on strength alone.

Coarse aggregate sizes listed are the nominal sizes given in Table 2 of ASTM C33. The gradation of the aggregate shall be within the tabulated limits.

1.5.1 Cement and Fly Ash Content. The quantity of Portland cement and flyash shall not be less than that required for the maximum water/cement ratios specified in the MIX CLASS TABLE.

If fly ash is used, the proportion of the fly ash and cement by weight shall be 20 percent fly ash and 80 percent cement.

1.5.2 Slump. Concrete slump shall be in accordance with the MIX CLASS TABLE and be kept at or above the maximum or as minimal as possible without sacrificing workability.

1.5.3 Ratio of Fine to Total Aggregates. The ratio of fine to total aggregates, based on solid volumes (not weights), shall be as follows.

Coarse Aggregate Size from No. 4 Sieve to	Ratio	
	Minimum	Maximum
3/4 inch	0.35	0.50
1 inch	0.30	0.46
1-1/2 inch	0.25	0.42

1.5.4 Initial Set. The initial set as determined by ASTM C403 shall occur between 3 and 5 hours after the water, cement, and aggregates are combined.

1.5.5 Admixtures. Admixtures shall be added to the mix in accordance with the manufacturer's recommendations. These admixtures shall not contain calcium chlorides or components containing chlorides other than residual impurities in the admixture ingredients.

A superplasticizing or plasticizing agent or plasticizing retarder shall be included in concrete if required by the mix design or placement proceedures. The quantity of retarder added to the mix shall provide the specified time limitation for initial set for the conditions present at placement.

1.5.6 Strength. Concrete strength shall exceed the minimum compressive strength specified in the MIX CLASS TABLE. If a test cylinder indicates concrete strength less than the specified minimum, the concrete represented by the test shall be investigated at FPL's option. This investigation shall include sampling and testing of the concrete in place to verify the results of the cylinder test. The Contractor shall cooperate with FPL during sampling and testing and shall pay all associated costs, including the replacement of concrete for the samples removed.

If this investigation verifies the existence of defective concrete, the following remedial actions shall be taken as determined by FPL:

- The removal and replacement of all defective concrete.
- The cost of design and construction changes necessary to incorporate the inferior concrete.
- Satisfactory reimbursement or allowance to FPL for the acceptance of the lower quality concrete.

1.6 STORAGE OF MATERIALS. Cement and fly ash shall be stored in suitable moistureproof enclosures. Reclaimed cement, or cement and fly ash that have become caked or lumpy, shall not be used.

Aggregates shall be stored to minimize segregation and contamination by foreign materials. The bottom 6 inches of aggregate storage piles that have been in contact with the ground shall not be used.

Reinforcing steel and embedments shall be stored on supports that minimize contact with the ground.

1.7 BATCHING AND MIXING. Batching and mixing shall be performed by an acceptable ready-mix concrete supplier.

1.7.1 Batching. Aggregates, fly ash, and cement shall be measured by weight. Aggregate weights shall be adjusted for the moisture content.

Admixtures shall be dispensed automatically in the correct proportions.

The amount of water required to produce the desired slump shall be batched automatically. Additional water needed to maintain a uniform slump shall be added manually by the mixer operator. Slump shall be kept uniform. Aggregates shall float uniformly throughout the mass. The concrete shall flow sluggishly when vibrated.

1.7.2 Mixing. Concrete shall be mixed until all ingredients are uniformly distributed throughout the batch. Mixers shall not be loaded in excess of their rated capacities. Each batch shall be completely discharged before the mixer is recharged.

1.7.3 Ready-Mixed Concrete. Ready-mixed concrete shall conform to ASTM C94, except as otherwise specified.

Truck mixers shall have a revolving drum, shall be equipped with a mixing water tank, and shall be in accordance with the requirements of the National Ready Mixed Concrete Association (NRMCA). The required amount of mixing water for the concrete mix shall be placed in the tank, unless the tank is equipped with a metering device that allows verification of the water amount added to each batch.

A delivery ticket shall be prepared for each load of ready-mixed concrete. At the time of delivery, the truck operator shall hand a copy of each ticket to the representative designated by FPL. The Contractor shall provide a copy of each ticket to FPL or representative designated by FPL. Tickets shall indicate the mix identification, the number of yards delivered, the quantities of each material in the batch, the outdoor temperature in the shade, the time the cement and water was added, and the numerical sequence of the delivery.

After the addition of water to the cement, truck mixers shall discharge concrete within 1-1/2 hours and before the mixing drum makes 300 revolutions. In hot weather, or under conditions contributing to quick setting of concrete, a time shorter than 1-1/2 hours may be required by FPL. When a truck mixer is used for the complete mixing of the concrete, the mixing operation shall begin within 30 minutes after the cement has been added to the aggregates.

1.8 FIELD CONTROL TESTING. With the exception of the fly ash and aggregate gradation tests which shall be performed at the batch plant, the following field control tests shall be made at the point of placement as directed by FPL.

Equipment, supplies, and qualified personnel necessary for the field control testing shall be supplied by an independent testing laboratory or qualified contractor personnel approved by FPL. Tests shall be performed by an independent testing laboratory or qualified contractor personnel approved by FPL.

The frequency specified for each field control test is a minimum. Additional field control tests shall be made if requested by FPL.

All testing costs are by Contractor.

1.8.1 Fly Ash. Each 400 tons of fly ash shall be sampled and tested in accordance with ASTM C618 and C311, respectively.

Certified copies of Contractor (source) test reports shall be furnished to FPL. These reports shall include chemical composition, physical analysis, and certification that fly ash complies with these specifications.

1.8.2 Aggregate Gradation. Each 750 tons of fine aggregate and each 1,500 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136. A minimum of one gradation test for each aggregate shall be performed.

1.8.3 Slump. A slump test shall be made from each of the first three batches mixed each day. An additional slump test shall be made for each additional 50 cubic yards of concrete placed that day. Slump shall be determined in accordance with ASTM C143.

When plasticizers and superplasticizers are added at the site, the slump shall be measured and recorded before and after the addition.

1.8.4 Air Content. An air content test shall be made from one of the first three batches mixed each day and from each batch of concrete used to make compression test cylinders. Air content shall be determined in accordance with ASTM C231.

1.8.5 Compression Tests. Concrete compression test cylinders shall be made each day concrete is placed.

For slabs, foundations and walls, a minimum of one set of four test cylinders shall be made from the same batch for each of the following quantity intervals placed each day. As a minimum, one set of four test cylinders shall be made for each major equipment foundation.

0 to 25 cubic yards.

25 to 100 cubic yards.

Each additional 100 cubic yards or fraction thereof.

For paving, a minimum of one set of four test cylinders shall be made from the same batch for each of the following quantity intervals placed each day.

50 cubic yards or 2500 square feet

Ductbank and mudmat concrete are excluded from testing, unless requested by FPL.

The Contractor shall provide additional compression test cylinders if required by FPL.

For each set of four cylinders, one cylinder shall be tested at an age of 7 days, two cylinders shall be tested at an age of 28 days, and one shall be stored until otherwise directed by FPL. Any additional cylinders required by FPL will be tested as directed by FPL.

Concrete test cylinders shall be made and handled in accordance with ASTM C31 and tested in accordance with ASTM C39.

Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the delivery truck or batch number, the air content, and the slump.

1.8.6 Test Reports. The Contractor shall furnish FPL certified reports of all tests.

1.9 REINFORCEMENT. Reinforcement shall be accurately formed. The details of fabrication shall conform to ACI 318.

1.9.1 Accessories. Bar supports, ties, spacers, bolsters, inserts, screeds, and other concrete accessories used to secure reinforcing in position shall be furnished.

1.9.2 Certification. Certification of compliance with these specifications shall be provided for all reinforcing steel furnished.

1.9.3 Tensile Tests. Tensile tests shall be performed in accordance with ASTM A615.

1.9.4 Welding. Welding of reinforcement required for design is prohibited. Reinforcement with unauthorized welds shall be removed and replaced. Welding is acceptable to supplementary reinforcement added for support of embedded items. Supplementary reinforcement shall not be welded to structural design reinforcement.

Welded chairs and supports may be used.

1.9.5 Shop Drawings and Bar Lists. Bar lists and reinforcement placement drawings shall be submitted to FPL for review for those foundations requested to be submitted by FPL. Each bar list and placement drawing shall have a statement identifying the grade of reinforcing required by that drawing.

1.9.6 Concrete Cover. Metal reinforcement for concrete shall have the concrete protective cover specified in Chapter 7 of ACI 318.

1.9.7 Placement. Reinforcement shall be accurately positioned and secured in place with wire ties or suitable clips. Bare metal supports shall not be used in contact with forms for exposed surfaces.

The clear distance between individual parallel bars shall not be less than 1.5 times the maximum size of coarse aggregate in the concrete; nor less than one nominal bar diameter; nor less than 1 inch in beams, 1-1/2 inches in columns, or 2 inches in other locations. Where reinforcements in beams are placed in two or more layers, the bars in the upper layer shall be placed directly above the bars in the lower layer and the clear distance between layers shall not be less than 1 inch. Clear distance limitations between individual bars shall also apply to the clear distance between a contact lap splice and adjacent splices or bars.

1.9.8 Splices. Splices shall conform to ACI 318. Class B tension-lapped splices shall be used unless otherwise indicated on the drawings. Splices in horizontal reinforcement placed in vertical wall sections shall be detailed in accordance with the top reinforcement requirements of ACI 318.

Splices shall not be used in regions of maximum bending stress, unless approved by FPL prior to splicing.

1.10 FORMS. Forms shall be designed and constructed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Tolerances shall be in accordance with ACI 117. The offset between adjacent pieces of formwork facing material shall be Class C for surfaces exposed to view and may be Class D for concealed surfaces as defined by ACI 117.

Vertical surfaces of footings extended above grade shall be formed.

1.10.1 Construction. Forms shall be sufficiently tight to prevent leakage of mortar. They shall maintain position, shape, and alignment during and after placement of concrete.

Suspended members supported by concrete columns or piers shall be formed to allow the column or pier forms to be removed without disturbing the supports for the suspended members.

1.10.2 Form Ties. Form ties shall be the removable end, permanently embedded body type, and shall have sufficient strength, stiffness, and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Outer ends of the permanently embedded portions of form ties shall be at least 1 inch back from adjacent outer concrete faces. Permanently embedded portions of form ties that are not provided with threaded ends shall be constructed to allow the removable ends to be broken off by twisting without chipping or spalling the concrete surface. Form ties shall be acceptable to FPL.

Form ties in exposed surfaces shall be uniformly spaced in a uniform manner.

1.10.3 Edges and Corners. Chamfer strips shall be placed in forms to bevel all salient edges and corners except buried edges and edges that are designated on the drawings to receive special treatment. Equipment bases shall have formed beveled salient edges for all vertical and horizontal corners unless indicated otherwise on the drawings. Bevel dimensions shall be 3/4 by 3/4 inch unless indicated otherwise on the drawings.

1.10.4 Form Removal. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support the applied loads. Supports beneath beams or slabs shall be left in place and reinforced as necessary to carry any construction loads placed on them. Forms shall be removed without damaging the concrete.

1.11 EMBEDMENTS. Anchor bolts, castings, steel shapes, conduit, sleeves, masonry anchorages, and other materials embedded in the concrete shall be accurately positioned and securely anchored.

Unless more stringent tolerances are specified on the drawings, the installation of anchor bolts/rods, foundation bolts/rods and other embedded items shall be in accordance with the tolerances specified by the American Institute of Steel Construction (AISC), Code of Standard Practice for Steel Buildings and Bridges, March 18, 2005.

Anchor bolts installed without pipe sleeves shall be provided with sufficient threads to permit a nut to be installed on each side of the form or template. The nuts shall secure the bolt in its proper position.

Embedments shall not be welded to reinforcement. Welding is acceptable to supplementary reinforcement added for support of embedded items. Supplementary reinforcement shall not be welded to structural design reinforcement.

Embedments shall be clean when they are installed. After concrete placement, exposed surfaces of embedments shall be cleaned of all concrete spatter and other foreign substances.

Anchor bolt sleeves, handrail sleeves, and similar openings in concrete susceptible to filling with water and freezing shall be filled with closed cell PVC expansion joint filler. The upper neck of Wilson Anchor Sleeves shall be cut out and the annular space filled with closed cell PVC expansion joint filler.

1.12 PLACEMENT. The handling, depositing, and compacting of concrete shall conform to these specifications. Adjustment may be made by FPL for weather or placement conditions.

Concrete shall not be pumped through aluminum or aluminum alloy pipe.

Loose pieces of rock shall be removed and the exposed surface cleaned before concrete is placed.

The space receiving concrete shall be cleaned and cleared of debris and standing water, and the entire installation shall be acceptable to FPL before concrete is placed.

Surfaces encrusted with dried mortar or concrete from previous placement operations shall be cleaned before placing new concrete.

1.12.1 Bonding to Hardened Concrete. The surface of hardened concrete, upon which fresh concrete or grout is placed, shall be rough, clean, and damp. Surface mortar shall be removed to expose sound aggregate. The hardened surface shall be cleaned of all foreign substances and loose concrete, washed with clean water, and kept saturated preceding placement of fresh concrete.

A 2 inch thick mortar puddle shall be deposited on hardened concrete in wall and column forms immediately before placing fresh concrete. The mortar puddle shall be the specified mix class with the coarse aggregate omitted.

1.12.2 Conveyance and Distribution. Concrete shall be conveyed to the placement location by methods that prevent separation or loss of the ingredients.

1.12.3 Depositing Concrete. Concrete shall be deposited in horizontal layers. The depth of a layer shall not exceed 2 feet. Each layer of concrete shall be plastic when succeeding layers are placed. The forms shall be filled at a rate of vertical rise of not less than 2 feet per hour. Concrete shall be deposited without moving it laterally in the forms for a distance exceeding 5 feet.

Plastic concrete is defined as concrete that allows an immersion type vibrator spud to penetrate the concrete at least 1 inch by vibration and its own weight.

Concrete shall remain plastic for at least 2-1/2 hours after initial contact of cement and water. Concrete that is no longer plastic shall be immediately chipped back to well consolidated concrete and slushed with mortar puddle. Mortar puddle shall be the specified concrete class with the coarse aggregate omitted. The preparation of the in-place concrete shall be acceptable to FPL before the successive layer of concrete is placed.

Concrete shall be deposited and compacted in wall or column forms before any reinforcing steel is placed in the system supported by these walls or columns. Concrete in walls or columns shall settle at least 2 hours before concrete is placed in the structural systems supported by these walls or columns.

1.12.4 Consolidation. Concrete shall be compacted in accordance with ACI 301-89 using mechanical immersion type vibrating equipment.

1.12.5 Hot Weather Concreting. Hot weather concreting shall be in accordance with the recommendations of ACI 305R. A water reducing retarder shall be added to the concrete mix when the placement temperature of the concrete exceeds 75° F.

At air temperatures of 90° F and above, special procedures shall be used to keep the concrete as cool as possible during placement and curing.

The temperature of the concrete shall not exceed 95° F when placed.

When the air temperature exceeds 95° F, membrane cured slabs shall be kept wet during the curing period.

1.13 CONSTRUCTION JOINTS. Construction joints shall be located and constructed as indicated on the drawings. If a different arrangement of construction joints is desired, drawings indicating the locations and details

of the proposed joints shall be submitted to FPL before detailing and fabricating reinforcing steel. These joints shall be installed only where acceptable to FPL.

All construction joints subjected to differential hydrostatic pressure shall be provided with a water stop. Water stops shall be furnished in other joints as indicated on the drawings.

Water stops shall be clean and free from coatings that weaken the bond with concrete. Each PVC water stop shall be continuous throughout the length of the joint. Intersections shall be made using factory prefabricated crosses, tees, and ells. Splices shall perform equal to continuous material and shall be made in strict conformance with the recommendations of the water stop manufacturer.

Water stops shall be maintained in proper position until the concrete has been deposited and compacted.

Rubber and plastic materials shall be stored in a cool place and shall not be exposed to direct sunlight.

1.14 EXPANSION JOINTS. Expansion joints shall be located and constructed as indicated on the drawings. Expansion joint filler shall be firmly bonded to the previously placed joint face with a suitable adhesive. The new concrete shall be poured directly against the joint filler. Accessible edges of each expansion joint shall be sealed.

Expansion joints indicated on the drawings and those subjected to differential hydrostatic pressure shall be provided with a flexible water stop.

Flexible water stops shall be spliced in strict conformance with the recommendations of the water stop manufacturer.

1.15 CONTROL JOINTS. Control joints shall be sawed joints 1/8 inch to 5/32 inch wide with a minimum depth of one fourth of the slab thickness, but not less than 1 inch. These joints shall be located as indicated on the drawings.

1.16 OPENINGS IN CONCRETE. Concrete wall and floor openings for piping and other fixtures, installed after the walls and floors are built, shall allow sufficient space to properly compact concrete to fill the space around the pipe or fixture. Each opening shall be provided with continuous keyways. The top of each wall opening shall be sloped or beveled to provide adequate space for placing and compacting the pipe embedment concrete. Water stops shall be provided around wall openings below grade and floor openings that are exposed to weather or submergence.

1.17 FINISHING FORMED SURFACES. Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be covered with earth backfill. Projecting ends of all form ties shall be removed. The resulting recesses shall be cleaned, wetted, and filled with patching mortar.

1.18 FINISHING UNFORMED SURFACES. No surface treatment will be required for buried or permanently submerged concrete. Unformed surfaces, designated as screeded surfaces on the drawings, shall be finished by screeding only. Surfaces designated as floated surfaces and all surfaces not otherwise designated shall be finished by screeding and floating. Surfaces designated as troweled surfaces shall be finished by screeding, floating, and troweling.

Float finished and screeded surfaces shall be finished to provide a flat profile within 5/16 inch deviation as measured from a 10 foot straightedge. Trowel finished surfaces shall be finished to form a flat plane. The surface profile shall not deviate more than 3/16 inch when measured from a 10 foot straightedge.

1.18.1 Screeding. Screeding shall provide a concrete surface conforming to the designated elevations and contours with all aggregates completely embedded in adjacent mortar. Surface irregularities in screeded surfaces shall be limited to the tolerances specified.

1.18.2 Floating. The surfaces shall be screeded and given an initial float finish as soon as the concrete has stiffened sufficiently to work. Coarse aggregate disturbed by the float or causing a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance.

Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a smooth float finish of uniform texture and color.

Floating shall be performed with hand floats or suitable mechanical compactor floats.

1.18.3 Troweling. Surfaces designated on the drawings as trowel finish shall receive a steel trowel finish. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent excess cement from being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

1.18.4 Brooming. Brooming shall follow the float finish for surfaces of exterior slabs and surfaces, unless designated otherwise on the drawings. Brooming shall be done with an acceptable steel or fiber broom not less than 18 inches wide. Adjacent strokes of the broom shall overlap slightly. Broomed surfaces shall be free of porous spots, irregularities, depressions, and small pockets or rough spots.

1.18.5 Aggregate Exposure. Surface mortar shall be removed and the aggregate exposed from surfaces that will be covered with mortar, concrete, or grout at a later time. The method used shall be effective and acceptable to FPL.

1.18.6 Edging. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having a 1/4 inch corner radius.

1.18.7 Finishing Mortar. Finishing mortar shall be added if there is not sufficient mortar available from the concrete mix. The proportions for this finishing mortar shall be 225 pounds of concrete sand to one sack of portland cement, mixed with enough water for proper application. Slump for finishing mortar shall not exceed 2 inches.

1.19 SEPARATE FINISHES. Certain slab surfaces shall be finished with a separate concrete finish or floor covering if indicated on the drawings.

1.20 CURING. Concrete shall be protected from loss of moisture for not less than 7 days after the concrete is placed.

Troweled surfaces, except those that receive a separate finish or coating, shall be cured with a membrane curing compound. Float finished surfaces may be cured with either a membrane curing compound or with water. Only water curing shall be used if the surface receives a separate finish.

1.20.1 Water Curing. Water saturation of concrete surfaces shall begin as quickly as possible after initial set of the concrete. Water curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff. The concrete surface shall not be permitted to dry.

1.20.2 Membrane Curing. Membrane curing compound shall be applied within 30 minutes after final finishing of the surface or as soon as possible after finishing without causing damage to the surface. Membrane curing

compound shall be spray applied at a coverage in accordance with manufacturer's recommended rates. Membrane curing shall not be used on surfaces that will be covered at a later date with mortar, concrete, dampproofing, or any coating.

1.21 FLOOR SEALER. Where indicated on the drawings, concrete floors shall be given two coats of clear floor sealer in addition to that applied as membrane curing compound. The coating shall be applied at the end of the curing period before any traffic is permitted on the floor.

1.22 REPAIRING DEFECTIVE CONCRETE. Surface defects in formed concrete shall be repaired to the satisfaction of FPL within 24 hours. Concrete that is porous, honeycombed, or otherwise defective to a depth in excess of 1 inch shall be cut out and removed to sound concrete. Edges shall be square cut to avoid feathering. Cut surfaces shall be coated with epoxy bonding compound before the concrete is placed.

Defective concrete shall be replaced within 48 hours after the forms have been removed.

Concrete repair work shall not interfere with the curing of surrounding concrete. Mortar and concrete used in repair work shall be adequately cured and shall be finished to match adjacent surfaces.

1.23 FUTURE BONDING. Areas of cast-in-place concrete structures requiring multiple concrete placements shall have any exposed reinforcements and other metal embedments indicated on the drawings protected from corrosion and mechanical damage. These shall be painted with two coats of epoxy bonding compound. Surfaces shall be thoroughly cleaned and the compound prepared and applied in accordance with the manufacturer's written instructions.

EXHIBIT A – CONCRETE MIX DESIGN SUBMITTAL FORM

Concrete Mix Design Submittal Form

Submitted by Concrete Contractor

Name _____

Address _____

Phone No. _____ **Date** _____

Main Plant Location _____ **Miles from Project** _____

Secondary Plant Location _____ **Miles from Project** _____

Project Name _____ **Location** _____

Project No. _____ **Specification No.** _____

General Contractor _____

Mix Design No. _____ **Concrete Grade** _____

Mix Description _____

Design Mix Information

☐ **Based on Standard Deviation Analysis** ☐ **Trial Mix Test Data**

Design Characteristics

Density _____ **pcf (lb/m^3)** **Strength** _____ **psi (kPa) (28 day; 45 day for Type V cement)**

Slump _____ **in. (mm) required BEFORE High Range, Water Reducing Admixture** **Slump** _____ **in. (mm) required AFTER High Range, Water Reducing Admixture**

Air _____ **percent specified**

Materials

Aggregates	**Size**	**Type**	**Gradation**	**Fineness Modulus**	**Controlling Spec**
Coarse					
Fine					

Other Materials	**Type**	**Manufacturer/Source**
Cement		
Fly Ash		
Other		

Admixtures	**Product Name**	**Manufacturer**
Water Reducer		
Air-Entraining Agent		
High Range, Water Reducing Admixture		
Noncorrosive Accelerator		
Other		

Standard Deviation Analysis (from experience records)

Number of Test Cylinders Evaluated _____ **Standard Deviation** _____

f'cr = f'c + 1.34s or f'cr = f'c + 2.33s - 500
(Refer to ACI 301 for increased deviation factor when less than 30 tests are available.)

Trial Mixtures - Laboratory Test Data (hardened concrete)

		Compressive Strength	
Age (days)	**Mix No. 1**	**Mix No. 2**	**Mix No. 3**
7			
7			
7			
28			
28			
28			
45			
45			
45			

28 day average compressive strength _____ **psi (kPa)**

45 day average compressive strength _____ **psi (kPa)**

Mix design proportioned to achieve f'cr = f'c + 1,200 psi (__ kPa) [1,400 psi (__ kPa) for strength higher than 5,000 psi (__ kPa) at 28 days]

Note: Fill in all blank spaces. Use -0- (zero) or NA (not applicable) where appropriate. Refer to "Design and Control of Concrete Mixtures," 13th Edition, by Portland Cement Association for assistance in completing this form.

Mix No. _____ **Job Name** _____

Final Mix Design Data

Components

Water	_____	**lb (kg)**
Cementitious Materials (C)	_____	**lb (kg)**
Water-Cement Ratio	_____	
Fine Aggregate (FA)	_____	**lb (kg)**
Total Aggregate (TA)	_____	**lb (kg)**
FA/TA	_____	**percent**

Specific Gravities

Fine Aggregate _____

Coarse Aggregate _____

Mix Proportions

	Weight, lb (kg)	Absolute Vol, ft^3 (m^3)
Cement		
Pozzolan (or mineral admixture)		
Fine Aggregate		
Coarse Aggregate		
Water		
Entrained Air		
Other		
Totals		

Admixtures [oz per 100 lb (___ g per 45 kg) cement]

High Range Water Reducer _____ **Noncorrosive Accelerator** _____

Water Reducer (Plasticizer) _____ **Air-Entraining Agent** _____

Plastic Concrete

Initial Slump = _____ **in. (mm)** **Air Content =** _____ **percent**

Final Slump = _____ **in. (mm)** **Unit Dry Weight =** _____ **pcf (kg/m^3)**

Unit Wet Weight = _____ **pcf (kg/m^3)** **Initial Set =** _____ **hours**

Required Attachments

- **Aggregate Reports**
  - **Fine Aggregate**
    - **Source, type**
    - **Gradation**
    - **Fineness modulus**
    - **Deleterious materials**
    - **Water soluble chloride ion content**

- **Sand equivalent value**
- **Potential reactivity report (when specified)**

Coarse Aggregate

- **Source, type**
- **Gradation**
- **Deleterious materials**
- **Abrasion loss**
- **Soundness**
- **Water soluble chloride ion content**
- **Potential reactivity report (when specified)**

Cement Mill Test Report

Fly Ash or Other Pozzolan Material Test Report

Admixtures

- **Data Sheets**
- **Certification of Compliance and Product Compatibility**