



Leon County

Board of County Commissioners

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(850) 606-5302 www.leoncountyfl.gov

Purchasing Division
2284 Miccosukee Road
Tallahassee, Florida 32308
(850) 606-1600

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December 14, 2009

RE: Bid Title: Resurface Gum Road Transfer Station Tip Floor

Bid No: BC-12-17-09-10

Opening Date: CHANGED TO: December 22, 2009 at 2:00 PM

ADDENDUM #3

Dear Vendor:

This letter serves as Addendum #3 for the above referenced project.

A new set of specifications dated November 2009 has been posted on the Leon County website at: <http://www.leoncountyfl.gov/Purchasing/Plan&Specs/index.asp> and attached to this addendum for your use in preparing your bid. Items discussed at the pre-bid conference (ie: cement aggregate, testing) are answered in this update set of specs.

Leon County shall place a waste container at the site and be responsible for removal of waste materials.

The last day for questions has been extended to Tuesday, December 15, 2009, at 5:00 PM.

The opening date has been changed to: Tuesday, December 22, 2009 at 2:00 PM.

Acknowledgment of this addendum is required as part of your bid submittal. Failure to acknowledge this addendum may result in rejection of your bid.

Should you have any questions, feel free to call me at (850) 606-1600.

Sincerely,

A handwritten signature in black ink, appearing to read "Don Tobin", written over a horizontal line.

Don Tobin, CPPB
Purchasing Agent

DT

1 **SECTION 03311**
2 **CONCRETE MIXING, PLACING, JOINTING, AND CURING**

3 **PART 1 - GENERAL**

4 **1.1 SUMMARY**

- 5 A. Section Includes:
6 1. Mixing, placing, jointing, and curing of concrete construction.
7 B. Related Sections include but are not necessarily limited to:
8 1. Section 03308 - Concrete, Materials and Proportioning.
9 2. Section 03348 - Concrete Finishing and Repair of Surface Defects.
10 3. Section 03350 - Testing.

11 **1.2 QUALITY ASSURANCE**

- 12 A. Referenced Standards:
13 1. American Concrete Institute (ACI):
14 a. 116R, Cement and Concrete Terminology.
15 b. 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
16 c. 304.2R, Placing Concrete by Pumping Methods.
17 d. 305R, Hot Weather Concreting.
18 e. 308, Standard Practice for Curing Concrete.
19 f. 309R, Guide for Consolidation of Concrete.
20 2. American Society for Testing and Materials (ASTM):
21 a. C94, Standard Specification for Ready-Mixed Concrete.
22 b. C171, Standard Specification for Sheet Materials for Curing Concrete.
23 c. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing
24 Concrete.
25 d. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete
26 (Bituminous Type).
27 e. D1056, Standard Specification for Flexible Cellular Materials Sponge or Expanded
28 Rubber.
29 f. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving
30 and Structural Construction (Non-Extruding and Resilient Bituminous Types).
31 3. National Ready Mixed Concrete Association (NRMCA):
32 a. Check List for Certification of Ready Mixed Concrete Production Facilities.
33 B. Qualifications:
34 1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.
35 C. A concrete preconstruction meeting will be held prior to the initial concrete placement at the
36 Owner's field office. Attendance will be required of the concrete supplier, contractor's
37 superintendent, and foremen responsible for concrete placement, concrete placing and Owner's
38 representatives, and testing agency. The agenda will include but is not limited to the following
39 1. Scheduling and notification of concrete placements and notification of testing agency.
40 2. Delivery time from batch plant and maximum waiting period prior to placing concrete.
41 3. Review of approved design mix including the limits of water that can be added and who is
42 authorized to add water.
43 4. Additional test cylinders to be made for any load in which water has been added on site.
44 5. Authority of testing agency.
45 6. Finishing and curing procedures.
46 7. Temperature control.
47 8. Test cylinder storage and protection.

48 **1.3 DEFINITIONS**

- 49 A. Words and terms used in this Specification are defined in ACI 116R.

1 **1.4 SUBMITTALS**

- 2 A. Shop Drawings:
3 1. See Contract Documents.
4 2. Product technical data including:
5 a. Acknowledgement that products submitted meet requirements of standards referenced.
6 b. Manufacturer's installation instructions.
7 c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction
8 joints and joint keyway dimensions.
9 d. Manufacturers and types:
10 1) Joint fillers.
11 2) Curing products.
12 3) Construction joint bonding adhesive.
13 3. Certifications:
14 a. Ready mix concrete plant certification.
- 15 B. Miscellaneous:
16 1. Copies of concrete delivery tickets.
17 2. Description of proposed curing methods.

18 **1.5 PROJECT CONDITIONS**

- 19 A. Adjust concrete mix design when material characteristics, job conditions, weather, strength test
20 results or other circumstances warrant.
21 1. Do not use revised concrete mixes until submitted to and approved by Testing Agency and/or
22 Engineer.
- 23 B. Project is phased to allow the Owner's partial use of the facility. The Contractor shall coordinate
24 the work to minimize disruption of facility's operation.

25 **1.6 DELIVERY, STORAGE AND HANDLING**

- 26 A. Delivery:
27 1. Concrete:
28 a. Prepare a delivery ticket for each load of ready mixed concrete.
29 b. Truck operator shall hand ticket to Contractor at the time of delivery.
30 c. Ticket to show:
31 1) Mix identification.
32 2) Quantity delivered.
33 3) Amount of material in each batch.
34 4) Outdoor temperature in the shade.
35 5) Time at which cement was added
36 6) Time of delivery.
37 7) Time of discharge.
38 8) Amount of water added, both at the batch plant and at the job site (if any).

39 **1.7 SEQUENCING AND SCHEDULING**

- 40 A. Do not begin concrete production until proposed concrete mix design has been approved by Testing
41 Agency and/or Engineer.
42 1. Approved of concrete mix design does not relieve Contractor of his responsibility to provide
43 concrete that meets the requirements of this Specification.

44 **PRODUCTS**

45 **2.1 COMPONENTS**

- 46 A. Neoprene Expansion Joint Fillers:
47 1. Manufacturers:
48 a. Permaglaze.
49 b. Rubatex.
50 c. Williams Products.

- 1 2. Materials:
- 2 a. Closed cell neoprene.
- 3 b. ASTM D1056, Class SC, 2 to 5 psi compression deflection, Grade SCE-41.
- 4 B. Asphalt Expansion Joint Fillers:
- 5 1. Manufacturers:
- 6 a. W R Meadows.
- 7 b. J and P Petroleum Products.
- 8 2. Materials: ASTM D994.
- 9 C. Fiber Expansion Joint Fillers:
- 10 1. Materials: ASTM D1751.
- 11 D. Membrane Curing Compound:
- 12 1. Comply with ASTM C309.
- 13 2. High solids.
- 14 3. Shall not prevent the bonding of future coverings, coatings, or finishes.
- 15 E. Sand cement grout, non-shrink grout and epoxy grout: See Section 03308.
- 16 F. Epoxy Bonding Agent
- 17 1. "Corr-Bond" by Euclid.
- 18 2. Sika Armatec 110" by Sika Corp.
- 19 3. "CR 246" by STO.
- 20 G. Submit requests for substitution to Engineer of Record.

21 **2.2 SOURCE QUALITY CONTROL**

- 22 A. The central concrete plant shall conform to the check list for certification of Ready Mixed Concrete
- 23 Production Facilities of the NRMCA.

24 **PART 3 - EXECUTION**

25 **3.1 PREPARATION**

- 26 A. General:
- 27 1. Complete formwork.
- 28 2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive
- 29 concrete.
- 30 3. Secure reinforcement in place.
- 31 4. Position expansion joint material, anchors and other embedded items.
- 32 5. Obtain approval of reinforcement erection and placement prior to placing concrete.
- 33 6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and
- 34 approval is obtained.
- 35 a. Plan size of crews with due regard for effects of concrete temperature and atmospheric
- 36 conditions on rate of hardening of concrete as required to obtain good surfaces and avoid
- 37 unplanned cold joints.
- 38 b. Do not allow rainwater to increase mixing water nor to damage surface finish.
- 39 7. Coat all construction joints with an approved bonding material or bed of grout, before new
- 40 concrete is placed. Apply proprietary bonding adhesive in accordance with manufacturer's
- 41 instructions.
- 42 8. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment
- 43 and formwork.
- 44 9. Provide slabs and beams of minimum indicated required depth when sloping structural
- 45 foundation base slabs and elevated slabs to drains. For floor slabs on grade, slope top of
- 46 subgrade to provide slab of required uniform thickness.
- 47 B. Preparation of Subgrade for Slabs On Ground:
- 48 1. Subgrade drained and of adequate and uniform load-bearing nature.
- 49 2. Obtain approval of subgrade compaction density prior to placing slabs on ground.

- 1 3. Maintain subgrade at a temperature above 32 DegF before concrete placing begins for a
- 2 sufficient amount of time to remove frost.
- 3 4. Moisten subgrade to eliminate absorption. Keep subgrade moist at time of concreting. Allow
- 4 no free-standing water on subgrade or soft or muddy spots when concrete is placed.
- 5 C. Edge Forms and Screeds:
- 6 1. Set accurately to produce designated elevations and contours of finished surface.
- 7 2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
- 8 3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to
- 9 contours of screed strips.

10 3.2 CONCRETE MIXING

- 11 A. General:
- 12 1. Provide all concrete from a central plant conforming to Check List for Certification of Ready
- 13 Mixed Concrete Production Facilities of the NRMCA.
- 14 2. Batch, mix, and transport in accordance with ASTM C94.
- 15 B. Control of Admixtures:
- 16 1. Charge admixtures into mixer as solutions.
- 17 a. Measure by means of an approved mechanical dispensing device.
- 18 b. Liquid considered a part of mixing water.
- 19 c. Admixtures that cannot be added in solution may be weighed or measured by volume if so
- 20 recommended by manufacturer.
- 21 2. Add separately, when two or more admixtures are used in concrete, to avoid possible
- 22 interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
- 23 3. Complete addition of retarding admixtures within one minute after addition of water to cement
- 24 has been completed, or prior to beginning of last three quarters of required mixing, whichever
- 25 occurs first.
- 26 C. Tempering and Control of Mixing Water:
- 27 1. Mix concrete only in quantities for immediate use.
- 28 2. Discard concrete which has set.
- 29 3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in
- 30 ASTM C94.
- 31 4. Addition of water at the jobsite:
- 32 a. See Section 03308 for specified water cement ratio and slump.
- 33 b. Do not exceed maximum specified water cement ratio or slump.
- 34 c. Incorporate water by additional mixing equal to at least half of total mixing required.
- 35 d. Perform strength test on any concrete to which water has been added at the jobsite. See
- 36 Section 03350.

37 3.3 PLACING OF CONCRETE

- 38 A. General:
- 39 1. Comply with ACI 304R and 304.2R.
- 40 2. Do not place concrete during rain, sleet, or snow.
- 41 3. Do not deposit concrete which has partially hardened or has been contaminated by foreign
- 42 materials.
- 43 4. Begin work only when work of other trades affecting concrete is complete.
- 44 5. Deposit concrete:
- 45 a. Continuously to avoid cold joints.
- 46 6. Locate construction joints at locations specified by the Engineer.
- 47 a. Plan size of crews with due regard for effects of concrete temperature and atmosphere
- 48 conditions to avoid unplanned cold joints.
- 49 7. Place concrete at such a rate that concrete, which is being integrated with fresh concrete, is still
- 50 workable.
- 51 8. Do not deposit concrete which has partially hardened or has been contaminated by foreign
- 52 materials.
- 53 9. Spreaders:
- 54 a. Temporary:

- 1) Remove as soon as concrete placing renders their function unnecessary.
 - b. Embedded:
 - 1) Obtain approval of Engineer.
 - 2) Materials: Concrete or metal.
 - 3) Ends of metal spreaders coated with plastic coating 2 IN from each end.
 10. Do not begin placing of concrete in supported elements until concrete previously placed in supporting members is no longer plastic and has been in place at least a minimum of 2 HRS.
 11. Deposit concrete as nearly as practicable in its final position to avoid segregation.
 - a. Maximum free fall: 4 FT.
 - b. Free fall exceeding 4 FT: 1) Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 4 FT of surface placed upon.
 12. Perform the following operations before bleeding water has an opportunity to collect on surface:
 - a. Spread.
 - b. Consolidate.
 - c. Straightedge.
 - d. Darby or bull float.
 13. No water shall be added to the concrete surface to ease finishing operation.
 14. Throughout placing of concrete, all mixing and placing equipment shall be kept free from oil, grease, rust and dirt to prevent color contamination of all white concrete.
- B. High-Range Water Reducers (Superplasticizers):
1. Add superplasticizer to the concrete at the batch plant.
 2. Perform concrete slump test at the jobsite after addition of the admixture to the concrete.
 3. Reference paragraph "Field Quality Control" and Section 03350 for additional required testing in field.
- C. Hot Weather Concrete Placement:
1. Comply with ACI 305R.
 2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
 3. Temperature of concrete when placed:
 - a. Not to exceed 90 DegF.
 - b. Not so high as to cause:
 - 1) Shrinkage cracks.
 - 2) Difficulty in placement due to loss of slump.
 - 3) Flash set.
 4. Temperature of forms and reinforcing when placing concrete:
 - a. Not to exceed 90 DegF.
 - b. May be reduced by spraying with water to cool below 90 DegF.
 - 1) Leave no standing water to contact concrete being placed.
 5. Prevent plastic shrinkage cracking and/or slab curling due to evaporation.
- D. Consolidating:
1. Consolidate in accordance with ACI 309R except as modified herein.
 2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
 - a. Eliminate:
 - 1) Air or stone pockets.
 - 2) Honeycombing or pitting.
 - 3) Planes of weakness.
 3. Internal vibrators:
 - a. Minimum frequency of 8000 vibrations per minute.
 - b. Insert and withdraw at points approximately 18 IN apart.
 - 1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
 - c. Use in:
 - 1) Beams and girders of framed slabs.
 - 2) Columns and walls.

- 1 d. Size of vibrators shall be in accordance with Table 5.1.5 of ACI 309R.
- 2 4. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or
- 3 other approved means.
- 4 5. Do NOT use vibrators to transport concrete within forms.
- 5 6. Do NOT excessively vibrate TRAPROCK concrete.
- 6 7. Provide spare vibrators on jobsite during all concrete placing operations.
- 7 8. Bring a full surface of mortar against form by vibration supplemented if necessary by spading
- 8 to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
- 9 9. Use suitable form vibrators located just below top surface of concrete, where internal vibrators
- 10 cannot be used in areas of congested reinforcing.
- 11 10. Prevent construction equipment, construction operations, and personnel from introducing
- 12 vibrations into freshly placed concrete after the concrete has been placed and consolidated.
- 13 E. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or
- 14 loss of ingredients and in a manner which will assure that required quality of concrete is maintained.
- 15 1. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94.
- 16 2. Horizontal belt conveyors:
- 17 a. Mount at a slope which will not cause segregation or loss of ingredients.
- 18 b. Protect concrete against undue drying or rise in temperature.
- 19 c. Use an arrangement at discharge end to prevent segregation.
- 20 d. Do not allow mortar to adhere to return length of belt.
- 21 e. Discharge conveyor runs into equipment specially designed for spreading concrete.
- 22 3. Metal or metal lined chutes:
- 23 a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.
- 24 b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used
- 25 provided they discharge into a hopper before distribution.
- 26 c. Provide end of each chute with a device to prevent segregation.
- 27 4. Pumping or pneumatic conveying equipment:
- 28 a. Designed for concrete application and having adequate pumping capacity.
- 29 b. Control pneumatic placement so segregation is avoided in discharged concrete.
- 30 c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.
- 31 d. Do not convey concrete through pipe made of aluminum or aluminum alloy.
- 32 e. Provide pumping equipment without Y sections.

33 **3.4 JOINTS AND EMBEDDED ITEMS**

- 34 A. General - Construction Joints:
- 35 1. Locate joints as indicated on Contract Drawings or as shown on approved shop drawings.
- 36 2. Unplanned construction joints will not be allowed. If concrete cannot be completely placed
- 37 between planned construction joints, then it must be removed.
- 38 3. Make joints perpendicular to main reinforcement with all reinforcement continuous across
- 39 joints.
- 40 4. Provide keyed construction joints at all new-to-new concrete construction joints unless
- 41 indicated otherwise on Drawings.
- 42 5. Construction joint keyways shall have the dimensions as shown on the Drawings or directed
- 43 otherwise by the Engineer.
- 44 6. Allow a minimum of 48 HRS before placement of contiguous concrete construction.
- 45 B. Construction Joints – Spacing unless otherwise specified:
- 46 1. General - Structures not intended to contain liquid:
- 47 a. Base slab, floor, and roof slab construction joints:
- 48 1) Placements to be approximately square and not to exceed 3000 SF.
- 49 2) Maximum side dimension of a slab pour to be 55 FT.
- 50 C. Bonding at Construction Joints:
- 51 1. Obtain bond between concrete pours at construction joints by thoroughly cleaning and
- 52 removing all laitance from construction joints. Before new concrete is placed, all construction
- 53 joints shall be coated with epoxy adhesive, cement grout, or water dampened.
- 54 2. Use epoxy adhesive for vertical wall joints, slab joints, and at all joints in beams, girders.
- 55 a. Joints receiving an adhesive shall be prepared, and the adhesive applied in accordance with
- 56 the manufacturer's recommendations.

- 1 b. Epoxy adhesive shall have adequate working life to allow new concrete to be placed while
2 the adhesive has not set.
- 3 3. Use sand-cement grout for all other construction joints, including wall/slab joints.
- 4 a) Treatment of joint surface:
- 5 (1) Roughen the surface of the concrete to expose the aggregate uniformly.
- 6 (2) Remove laitance, loosened particles of aggregate or damaged concrete at the
7 surface, or at the Contractor's option, use an approved chemical retarder
8 which delays but does not prevent setting of the surface of the mortar in
9 accordance with the manufacturer's recommendations. Retarded mortar shall
10 be removed within 24 HRS after placing to produce a clean exposed
11 aggregate bonding surface.
- 12 (3) Dampen the hardened concrete (but do not saturate) immediately prior to
13 placing of fresh grout.
- 14 b) Cover the hardened concrete of horizontal joints with a coat of cement grout of
15 similar proportions to the concrete, except substitute fine aggregate for coarse
16 aggregate.
- 17 (1) Place grout as thick as possible on vertical surfaces.
- 18 (2) Place 3 IN layer of grout in bottoms of wall or column lifts immediately
19 before placing concrete and at least 1/2 IN thick on other horizontal surfaces.
20 Vibrate grout and first layer of concrete simultaneously.
- 21 (3) Place fresh concrete before the grout has attained its initial set.
- 22 D. Control joints shall be located in members as indicated on Drawings.
- 23 1. Time cutting properly with set of concrete, if saw cut joints are required or permitted.
- 24 a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being
25 dislodged by saw.
- 26 b. Complete before shrinkage stresses become sufficient to produce cracking.
- 27 E. Expansion Joints:
- 28 1. Do not permit reinforcement or other embedded metal items bonded to concrete (except
29 smooth dowels bonded on only one side of joint) to extend continuously through an expansion
30 joint.
- 31 2. Use neoprene expansion joint fillers, unless noted otherwise on Drawings.
- 32 3. Seal expansion joints as shown on Drawings. See Section 07900 for requirements.
- 33 F. Other Embedded Items:
- 34 1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its
35 support, prior to initiating concreting.
- 36 a. Give Contractor whose work is related or integral to concrete, or supported by it, ample
37 notice and opportunity to furnish and install items before concreting.
- 38 2. Do not place electrical conduit, drains, or pipes in or thru concrete slabs, walls, columns,
39 foundations, beams or other structural members unless approved by Engineer.
- 40 G. Placing Embedded Items:
- 41 1. Position expansion joint material, waterstops, and other embedded items accurately.
- 42 2. Support against displacement.
- 43 3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to
44 prevent entry of concrete into voids.

45 **3.5 FINISHING**

- 46 A. Reference Section 03348 for details.
- 47 B. Provide slabs and beams of minimum indicated required depth when sloping structural foundation
48 base slabs and elevated slabs to drains. For floor slabs on grade, slope top of subgrade to provide
49 slab of required uniform thickness.

50 **3.6 INSTALLATION OF GROUT**

- 51 A. Grout Schedule of Use:
- 52 1. Sand cement grout:
- 53 a. Construction joint bedding.
- 54 b. General use.

- 1 2. Non-shrinking non-metallic grout:
 - 2 a. Filling form tie holes.
 - 3 b. Under column and beam base plates.
 - 4 c. Other uses indicated on the Drawings.
- 5 3. Epoxy grout:
 - 6 a. Patching cavities in concrete.
 - 7 b. Grouting of dowels and anchor bolts into existing concrete.
 - 8 c. Other uses indicated on the Drawings.
- 9 B. Grout Installation:
 - 10 1. Sand cement grout:
 - 11 a. Consolidate grout by rodding or by other effective means to assure complete filling of
 - 12 keyways.
 - 13 b. Cure grout by one of methods specified.
 - 14 2. Non-shrink non-metallic grout:
 - 15 a. Clean concrete surface to receive grout.
 - 16 b. Saturate concrete with water for 24 HRS prior to grouting.
 - 17 c. Mix in a mechanical mixer.
 - 18 d. Use no more water than necessary to produce flowable grout.
 - 19 e. Place in accordance with manufacturer's instructions.
 - 20 f. Provide under beam, column, and equipment base plates, in joints between precast concrete
 - 21 filter slabs, and in other locations indicated on the Drawings.
 - 22 g. Completely fill all spaces and cavities below the top of base plates.
 - 23 h. Provide forms where base plates and bed plates do not confine grout.
 - 24 i. Where exposed to view, finish grout edges smooth.
 - 25 j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed
 - 26 plate, member or piece of equipment.
 - 27 k. Coat exposed edges of grout with cure or seal compound recommended by the grout
 - 28 manufacturer.
 - 29 3. Epoxy grout:
 - 30 a. Mix and place in accordance with manufacturer's instructions.
 - 31 b. Apply only to clean, dry, sound surface.
 - 32 c. Completely fill all cavities and spaces around dowels and anchors without voids.
 - 33 d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
 - 34 e. Obtain manufacturer's field technical assistance as required to assure proper placement.

35 3.7 CURING AND PROTECTION

- 36 A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury
 - 37 immediately after placement, and maintain with minimal moisture loss at relatively constant
 - 38 temperature for period necessary for hydration of cement, hardening, and compressive strength gain.
 - 39 Follow recommendations of ACI 308 except as modified herein.
- 40 B. Apply one of the following curing procedures immediately after completion of placement and
 - 41 finishing.
 - 42 1. Ponding or continuous sprinkling.
 - 43 2. Application of absorptive mats or fabric kept continuously wet.
 - 44 3. Application of sand kept continuously wet.
 - 45 4. Continuous mist spray application.
 - 46 5. Application of waterproof sheet materials, conforming to ASTM C171.
 - 47 6. Application of other moisture retaining covering as approved.
 - 48 7. Application of a curing compound.
 - 49 a. 6000 psi concrete shall be cured with both a curing compound and one of the methods
 - 50 listed in 1-6 (above).
 - 51 b. Apply curing compound in accordance with manufacturer's recommendations immediately
 - 52 after any water sheen which may develop after finishing has disappeared from concrete
 - 53 surface.
 - 54 c. Do not use on any surface against which additional concrete or other material is to be
 - 55 bonded unless it is proven that curing compound will not prevent bond.
 - 56 d. All surfaces shall be covered with two coats of curing compound.

- 1) Allow preceding coat to completely dry prior to applying next coat.
 - 2) Apply second coat perpendicular to the application directions of preceding coat.
 - 3) One coat application will not be permitted.
- e. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two coats of the curing compound.
- 1) Apply the first coat of curing compound to a vertical surface immediately after form removal.
 - 2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - 3) Allow the preceding coat to completely dry prior to applying the next coat.
 - 4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.
- C. Curing Concrete In Contact with Forms:
1. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to solar heating by keeping forms wet and cool until they can be safely removed.
 2. After form removal, cure concrete until end of time prescribed.
 - a. Use one of methods listed above.
 3. Forms left in place shall not be used as a method of curing in hot weather.
 4. The term "hot weather," where used in these specifications, is defined in ACI 305R.
 5. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.
- D. Continue curing for at least 7 days. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is 1 day old, provided concrete is not permitted to become surface dry during transition.
- E. Hot Weather:
1. Follow recommendations of ACI 305R.
 2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
 3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.
- F. Rate of Temperature Change:
1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.
 2. Do not exceed a temperature change of 5 DegF in any 1 HR or 50 DegF in any 24 HR period.
- G. Protection from Mechanical Injury:
1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
 2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
 3. Do not load self supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

- A. Tests in accordance with Section 03350.
1. Perform a strength test on all concrete to which water or superplasticizer, in addition to the amount stated in the concrete mix design, has been added at the jobsite.
 - a. Perform strength test after water or superplasticizer has been added and additional mixing has been performed.

END OF SECTION

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SECTION 03348
CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete finishing and repair of surface defects.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 03311 - Concrete Mixing, Placing, Jointing, and Curing.
 - 2. Section 03308 - Concrete, Materials and Proportioning.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 116R, Cement and Concrete Terminology.
 - b. 224.1R, Causes, Evaluation and Repair of Cracks in Concrete Structures.
 - c. 301, Standard Specifications for Structural Concrete.
 - 2. American Society for Testing and Materials (ASTM):
 - a. C150, Standard Specification for Portland Cement.
 - b. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

1.3 DEFINITIONS

- A. Surface Defects:
 - 1. Any void in the face of the concrete deeper than 1/8 IN, such as:
 - a. Tie holes; anchor holes.
 - b. Air pockets (bugholes).
 - c. Honeycombs.
 - d. Rock holes.
 - 2. Scabbing:
 - a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
 - 3. Foreign material embedded in face of concrete.
 - 4. Fins 1/16 IN or more in height.
 - 5. Cracks – see below.
- B. Cracks to be repaired: any crack that reduces the strength, stiffness, or durability of structure or that seriously impairs function of structure. (Reference ACI 224.1R)
- C. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 1. Installer or applicator are synonymous.
- D. Other words and terms used in these Specifications are defined in ACI 116R.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Contract Documents.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
- B. Miscellaneous Submittals:
 - 1. Certification of aggregate gradation.

- 1 2. Certification that products being used will not interfere with bonding of future finishes.
2 C. Repair Procedures.

3 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 4 A. Comply with manufacturer's recommendations and requirements for materials used.

5 **1.6 WARRANTY**

- 6 A. Provide warranty equal to specified manufacturer's standard warranty for all products used.

7 **PART 2 - PRODUCTS**

8 **2.1 ACCEPTABLE MANUFACTURERS**

- 9 A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
10 1. Chemical floor hardeners:
11 a. L & M Construction Chemicals Inc.
12 b. Euclid Chemicals Co.
13 c. Dayton Superior.
14 2. Bonding agents:
15 a. Euclid Chemical Co.
16 b. Master Builders Inc.
17 c. L & M Construction Chemicals Inc.
18 d. Sika Corporation.
19 3. Two component epoxy adhesive for crack repairs:
20 a. Sika Corporation.
21 b. Euclid Chemical.
22 c. Contech group.
23 B. Submit requests for substitution to Engineer of Record.

24 **2.2 MATERIALS**

- 25 A. Chemical Floor Hardener:
26 1. Colorless deep penetrating solution containing 100-percent active silicate chemicals with non-
27 acid penetrant.
28 a. Meet Fed Spec CEGS 03300.
29 2. Provide materials which do not react with, inhibit or otherwise interfere with adhesives for
30 bonding future floor finishes.
31 3. Similar "Seal Hard" by L & M, or "Diamond Hard" by Euclid.
32 B. Bonding Agent:
33 1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to
34 improve adhesion and mechanical properties of concrete patching mortars.
35 2. Euclid Chemical Co. "Flex-Con."
36 3. Master Builders Inc. "Acryl-Set."
37 4. L & M Construction Chemicals "Everbond."
38 5. Thoro System Products "Acryl 60."
39 6. Bonding agents listed in this specification shall only be used for the repair of surface defects.
40 C. Cement:
41 1. ASTM C150, Type I/II Portland.
42 D. Aggregate:
43 1. Sand: Maximum size #30 mesh sieve.
44 2. For exposed aggregate finish surfaces: Same as surrounding wall.
45 E. Water: Potable.

46 **2.3 MIXES**

- 1 A. Bonding Grout:
- 2 1. One part cement to one part aggregate.
- 3 2. Mix cement and aggregate.
- 4 3. Mix bonding agent and water together in separate container in accordance with manufacturer's
- 5 instructions.
- 6 4. Add bonding agent/water mixture to cement/aggregate mixture.
- 7 5. Mix to consistency of thick cream.
- 8 6. Bonding agent itself may be used as bonding grout if approved by manufacturer and Engineer.
- 9 B. Patching Mortar:
- 10 1. One part cement to two and one-half parts aggregate by damp loose volume.
- 11 a. Substitute white Portland cement for a part of gray Portland cement to produce color
- 12 matching surrounding concrete.
- 13 2. Mix cement and aggregate.
- 14 3. Mix bonding agent and water together in separate container in accordance with manufacturer's
- 15 instructions.
- 16 4. Add only enough bonding agent/water mixture to cement/aggregate mixture to allow handling
- 17 and placing.
- 18 5. Let stand with frequent manipulation with a trowel, until mix has reached stiffest consistency to
- 19 allow placement.
- 20 C. Decorative Coating for Concrete:
- 21 1. Mix in accordance with manufacturer's recommendations using bonding agent acceptable to
- 22 coating manufacturer.

23 **PART 3 - EXECUTION**

24 **3.1 PREPARATION**

- 25 A. Repair surface defects within 72 HRS after removal of forms.
- 26 1. Chip, wire brush or abrasive blast to completely open defects down to sound concrete.
- 27 a. If chipping is necessary, make edges perpendicular to surface or slightly undercut.
- 28 b. No featheredges will be permitted.
- 29 B. Repairing Surface Defects:
- 30 1. Fill and repair using patching mortar mix specified in Article 2.3.
- 31 2. Clean surfaces to remove dust, dirt, laitence, form oil, grease, or other contaminants.
- 32 a. If required by bonding agent manufacturer, etch surfaces with a muriatic acid solution
- 33 followed by a thorough rinse with clean water.
- 34 b. Test concrete to determine pH level and continue flushing with clean water until surface
- 35 pH is within acceptable limits.
- 36 3. Dampen area to be patched and an area at least 6 IN wide surrounding it prior to application of
- 37 bonding grout.
- 38 4. Brush bonding grout into the surface after the surface water has evaporated.
- 39 5. Allow bonding grout to set for period of time required by bonding agent manufacturer before
- 40 applying premixed patching mortar.
- 41 6. Fill holes and areas where honeycombed or defective concrete has been removed.
- 42 a. Fill holes with non-shrink non-metallic grout. See Section 03308.
- 43 b. Consolidate grout or mortar into place and strike off so as to leave patch slightly higher
- 44 than surrounding surface.
- 45 7. Leave undisturbed for at least 60 minutes before finishing level with surrounding surface.
- 46 a. Do not use metal tools in finishing a patch in a formed wall which will be exposed or
- 47 coated with other materials.
- 48 8. Keep areas damp for 7 days or in accordance with bonding agent manufacturer's directions.

49 **3.2 INSTALLATION AND APPLICATION**

- 50 A. Do not repair surface defects or apply wall or floor finishes when temperature is or is expected to be
- 51 below 50 DegF.
- 52 1. If necessary, enclose and heat area to between 50 and 70 DegF during repair of surface defects
- 53 and curing of patching material.

- 1 B. Vertical Wall Finishes:
- 2 1. General: Give concrete surfaces finish as specified below after removal of formwork and repair
- 3 of surface defects.
- 4 2. Finish #1 - As cast rough form finish:
- 5 a. Selected forming materials are not required.
- 6 b. Prepare surface in accordance with paragraph 3.1-A. and repair the following surface
- 7 defects:
- 8 1) Tie holes.
- 9 2) Honeycombs deeper than 1/4 IN.
- 10 3) Air pockets deeper than 1/4 IN.
- 11 4) Rock holes deeper than 1/4 IN.
- 12 c. Chip or rub off fins exceeding 1/4 IN in height.
- 13 d. Provide this finish at unexposed surfaces such as foundations and backfilled surfaces of
- 14 walls not to be water-proofed.
- 15 3. Finish #2 - Smooth form finish:
- 16 a. Form facing material shall produce a smooth, hard, uniform texture. Use forms specified
- 17 for surfaces exposed to view in accordance with Section 03108.
- 18 b. Prepare surface in accordance with paragraph 3.1-A. and repair the following surface
- 19 defects:
- 20 1) Tie holes.
- 21 2) Honeycombs deeper than 1/8 IN or larger than 1/8 IN DIA.
- 22 3) Air pockets deeper than 1/8 IN or larger than 1/8 IN DIA.
- 23 4) Rock holes deeper than 1/8 IN or larger than 1/8 IN DIA.
- 24 5) Scabbing.
- 25 c. Chip or rub off fins exceeding 1/8 IN in height.
- 26 d. Provide finish for:
- 27 1) Interior containment walls, walls to be painted.
- 28 2) Walls being coated with some other material.
- 29 3) Exposed surfaces not specified to receive another finish.
- 30 4. Finish #3 - Smooth rubbed finish:
- 31 a. Form facing material shall produce a smooth, hard, uniform texture. Use forms specified
- 32 for surfaces exposed to view in accordance with Section 03108.
- 33 b. Prepare surface in accordance with paragraph 3.1-A. and repair all surface defects.
- 34 c. Begin finish operation 1 day after form removal.
- 35 d. Wet surface and rub with carborundum brick or other abrasive until uniform color and
- 36 texture is achieved.
- 37 e. No cement grout shall be used other than the cement paste drawn from concrete wall itself
- 38 by the rubbing procedure.
- 39 f. Provide this finish on all exposed to view exterior surfaces unless noted otherwise, such as
- 40 knee walls, columns, beams, and exterior walls.
- 41 g. Cementitious coating may be used in lieu of items d and e for this finish.
- 42 h. Construct mock-up per Article 1.3.
- 43 C. Related Unformed Surfaces (Except Slabs):
- 44 1. Strike smooth tops of walls or buttresses, horizontal offsets, and similar unformed surfaces
- 45 occurring adjacent to formed surfaces after concrete is placed.
- 46 2. Float surface to a texture consistent with that of formed surfaces.
- 47 3. Continue treatment uniformly across unformed surfaces.
- 48 D. Horizontal Slab Surface Finishes:
- 49 1. General: Tamp concrete to force coarse aggregate down from surface. Screed with straightedge,
- 50 eliminate high and low places, bring surface to required finish elevations; slope uniformly to
- 51 drains.
- 52 a. Dusting of surface with dry cement or sand during finishing processes not permitted.
- 53 b. Vacuum off any excess bleed water, so as not to delay finishing
- 54 c. No water shall be added to the concrete surface to ease finishing
- 55 2. Fiber reinforced slabs bleed less, and more slowly, thus assure that all bleed water is removed
- 56 before finishing.
- 57 3. Reference Article 3.3 for tolerances.

- 1 4. Unspecified slab finish: When type of finish is not indicated, use following finishes as
- 2 applicable:
- 3 a. All slabs to receive a floated finish before final finishing.
- 4 b. Surfaces intended to receive bonded applied cementitious applications: Scratched finish.
- 5 c. Surfaces intended to receive roofing (except future floors), waterproofing membranes, or
- 6 sand bed terrazzo: Floated finish.
- 7 d. Floors (except as otherwise specified): Troweled finish.
- 8 e. Ramps: Broom or belt finish.
- 9 f. Exterior slabs, sidewalks, platforms, steps and landings, and pedestrian ramps, not covered
- 10 by other finish materials: Broom or belt finish.
- 11 5. Scratched slab finish: After concrete has been placed, consolidated, struck off, and leveled to a
- 12 Class B tolerance, roughen surface with stiff brushes or rakes before final set.
- 13 6. Floated finish:
- 14 a. This finish shall be applied to Transfer Station floor between face of hoppers and column
- 15 line 3. DO NOT POWER TROWEL THIS AREA. Use only hand trowels to harden the
- 16 finish. DO NOT OVERWORK finishing in this area.
- 17 b. After concrete has been placed, consolidated, struck off, and leveled, do no further work
- 18 until ready for floating.
- 19 c. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to
- 20 permit operations. Use wood or cork float.
- 21 d. During or after first floating, check planeness of entire surface with a 10 FT straightedge
- 22 applied at not less than two different angles.
- 23 e. Cut down all high spots and fill all low spots to produce a surface with Class B tolerance
- 24 throughout.
- 25 f. Refloat slab immediately to a uniform texture.
- 26 7. Troweled finish:
- 27 a. Float finish surface to true, even plane.
- 28 b. Power trowel, and finally hand trowel.
- 29 c. First troweling after power troweling shall produce a smooth surface which is relatively
- 30 free of defects, but which may still show some trowel marks.
- 31 d. Perform additional trowelings by hand after surface has hardened sufficiently.
- 32 e. Final trowel when a ringing sound is produced as trowel is moved over surface.
- 33 f. Thoroughly consolidate surface by hand troweling.
- 34 g. Leave finished surface essentially free of trowel marks, uniform in texture and appearance
- 35 and plane to a Class A tolerance.
- 36 h. On surfaces intended to support floor coverings, remove any defects that would show
- 37 through floor covering by grinding.
- 38 8. Broom or belt finish: Immediately after concrete has received a float finish as specified, give it
- 39 a transverse scored texture by drawing a broom or burlap belt across surface.
- 40 E. Finishing of White Concrete: The use of metal tools on white concrete should be avoided. Do not
- 41 fog this concrete with water and/or add water with tools or brooms.

42 3.3 FIELD QUALITY CONTROL

- 43 A. Horizontal slab finishes will be accepted provided:
- 44 1. Applicable specification requirements are satisfied, including repair of defects.
- 45 2. Water does not pond in areas indicated as sloped.
- 46 3. Gap between a 10 FT straightedge placed anywhere and the finished surface does not exceed:
- 47 a. Class A tolerance: 1/8 IN.
- 48 b. Class B tolerance: 1/4 IN.
- 49 1) Unless otherwise specified, provide at all exposed to view concrete.
- 50 c. Class C tolerance: 1/2 IN.
- 51 1) Only acceptable for surfaces not exposed to view in completed construction.
- 52 4. Accumulated deviation from intended true plane of finished surface does not exceed 1/2 IN.
- 53 5. Accuracy of floor finish does not adversely affect installation and operation of movable
- 54 equipment, floor supported items, or items fitted to floor (doors, tracks, etc.).

1 B. Unacceptable finishes shall be replaced or, if approved in writing by Engineer, may be corrected
2 provided strength and appearance are not adversely affected. High spots to be removed by grinding
3 and/or low spots filled with a patching compound or other remedial measures to match adjacent
4 surfaces.

5 C.

6 **3.4 PROTECTION**

7 A. All horizontal slab surfaces receiving applied toppings or hardener sealer shall be kept free of traffic
8 and loads for minimum of 10 days following installation of topping or compound.

9 **END OF SECTION**

10

1 **SECTION 03350**
2 **CONCRETE TESTING**

3 **PART 1 - GENERAL**

4 **1.1 SUMMARY**

- 5 A. Section Includes:
- 6 1. Materials and concrete testing as required to establish cementitious mix designs.
 - 7 2. Testing of concrete materials and operations during construction for compliance with
8 Contract Documents.
 - 9 3. In-place testing of concrete, if required.
- 10
- 11 B. Related Sections include but are not necessarily limited to:
- 12 1. Section 03308 - Concrete, Materials, and Proportioning.
 - 13 2. Section 03311 - Concrete Mixing, Placing, Jointing, and Curing.

14 **1.2 RESPONSIBILITY AND PAYMENT**

- 15 A. Owner will hire an independent Testing Agency to perform the following testing and inspection
16 and provide test results to the Engineer and Contractor.
- 17 1. Testing and inspection of concrete and grout produced for incorporation into the work
18 during the construction of the Project for compliance with the Contract Documents.
 - 19 2. Additional testing or retesting of materials occasioned by their failure, by test or inspection,
20 to meet requirements of the Contract Documents.
 - 21 3. Strength testing on concrete required by the Engineer when the water-cement ratio exceeds
22 the water-cement ratio of the typical test cylinders.
 - 23 4. In-place testing of concrete as may be required by Engineer when strength of structure is
24 considered potentially deficient.
 - 25 5. Other testing services needed or required by Contractor such as field curing of test
26 specimens and testing of additional specimens for determining when forms, form shoring, or
27 reshoring may be removed.
 - 28 6. Owner will pay for services defined in Paragraph 1.2A.1.
- 29 B. Contractor shall hire a qualified testing agency to perform the following testing and provide test
30 result to the Engineer.
- 31 1. Testing of materials and mixes proposed by the Contractor for compliance with the Contract
32 Documents and retesting in the event of changes.
 - 33 2. Additional testing and inspection required because of changes in materials of proportions
34 requested by Contractor.
 - 35 3. Contractor shall pay for services defined in Paragraphs 1.2B.1 and 1.2B.2.
 - 36 4. Contractor shall pay for testing services defined in Paragraphs 1.2A.2., 1.2A.3., 1.2A.4 and
37 1.2A.5.
- 38 C. Testing Agency Authority:
- 39 1. Testing Agency and their representatives retained by Contractor or Owner are not
40 authorized to revoke, alter, relax, enlarge, or release any requirement of Contract
41 Documents, nor to reject, approve or accept any portion of the Work.
 - 42 2. Testing Agency shall inform the Contractor and Engineer regarding acceptability of or
43 deficiencies in the work including materials furnished and work performed by Contractor
44 that fails to fulfill requirements of the Contract Documents.
 - 45 3. Owner retains the responsibility for ultimate rejection or approval of any portion of the
46 Work.

47 **1.3 QUALITY ASSURANCE**

- 1 A. Referenced Standards:
- 2 1. American Association of State Highway and Transportation Officials (AASHTO):
- 3 a. T260, Standard Method of Sampling and Testing for Total Chloride Ion in Concrete
- 4 and Concrete Raw Materials.
- 5 2. American Concrete Institute (ACI):
- 6 a. 318, Building Code Requirements for Structural Concrete.
- 7 3. American Society for Testing and Materials (ASTM):
- 8 a. C31, Standard Method of Making and Curing Concrete Test Specimens in the Field.
- 9 b. C39, Standard Method of Test for Compressive Strength of Cylindrical Concrete
- 10 Specimens.
- 11 c. C42, Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of
- 12 Concrete.
- 13 d. C94, Standard Specifications for Ready Mixed Concrete.
- 14 e. C138, Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric)
- 15 of Concrete.
- 16 f. C143, Standard Method of Test for Slump of Portland Cement.
- 17 g. C172, Standard Method of Sampling Fresh Concrete.
- 18 h. C173, Standard Method of Test for Air Content of Freshly Mixed Concrete by the
- 19 Volumetric Method.
- 20 i. C192, Standard Method for Making and Curing Concrete Test Specimens in
- 21 Laboratory.
- 22 j. C231, Standard Method of Test for Air Content of Freshly Mixed Concrete by the
- 23 Pressure Method.
- 24 k. C496 Standard Method of Test for Splitting Tensile Strength of Cylindrical Concrete
- 25 Specimens.
- 26 l. C780, Standard Test Method for Preconstruction and Construction Evaluation of
- 27 Mortars for Plain and Reinforced Unit Masonry.
- 28 m. C1019, Standard Test Method for Sampling and Testing Grout.
- 29 n. E329, Standard Recommended Practice for Inspection and Testing Agencies for
- 30 Concrete, Steel, and Bituminous Materials as Used in Construction.
- 31 B. Building Code:
- 32 1. Florida Building Code, 2007 Edition, including local jurisdiction amendments.
- 33 C. Qualifications:
- 34 1. Testing Agency:
- 35 a. Meeting requirements of ASTM E329 and ASTM C94 and be approved by Engineer.
- 36 b. Provide evidence of recent inspection by Cement and Concrete Reference Laboratory
- 37 of National Bureau of Standards, and correction of deficiencies noted.

38 1.4 DEFINITIONS

- 39 A. Testing Agency: An independent professional testing firm or service hired by Contractor or by
- 40 Owner to perform testing and analysis services on materials, mixes, structures, procedures, and
- 41 other items as directed, and as provided in the Contract Documents.
- 42 1. Contractor selected agency must be approved in writing by Owner and Engineer.

43 1.5 SUBMITTALS

- 44 A. Shop Drawings:
- 45 1. See Contract Documents for requirements for the mechanics and administration of the
- 46 submittal process.
- 47 2. Product technical data including:
- 48 a. Concrete materials and concrete mix designs proposed for use. Include results of all
- 49 testing performed to qualify materials and to establish mix designs. Place no concrete
- 50 until approval of mix designs has been received in writing. Submittal for each concrete
- 51 mix design to include:
- 52 1) Sieve analysis and source of fine and coarse aggregates.

- 1 2) Test for aggregate organic impurities.
- 2 3) Proportioning of all materials.
- 3 4) Type of cement with mill certificate.
- 4 5) Brand, class, and certificate of conformance, of pozzolan proposed for use along
- 5 with other submittal data as required by Section 03308.
- 6 6) Slump and unit weight.
- 7 7) Brand, type and quantity of air entrainment and any other proposed admixtures.
- 8 8) Total chloride ion content per cubic yard of concrete determined in accordance
- 9 with AASHTO T260.
- 10 9) 28-day compression test results and any other data required by Section 03308 to
- 11 establish concrete mix design.
- 12 3. Certifications:
- 13 a. Testing Agency qualifications.
- 14 4. Test results:
- 15 a. Strength test results on concrete placed during construction including dates cast and
- 16 tested, mix design, project description, slump, air content, atmospheric and concrete
- 17 temperatures, and unit weights.
- 18 b. Strength test results on concrete core samples of in-place construction if required.
- 19 c. Results of load testing in-place concrete, if required.

20 **PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SECTION)**

21 **PART 3 - EXECUTION**

22 **3.1 TESTING AGENCY SERVICES**

- 23 A. Review and test Contractor's proposed materials for compliance with the Contract Documents,
- 24 including any Building Code Special Inspection requirements.
- 25 B. Review and test Contractor's proposed cementitious mix design(s).
- 26 C. Conduct tests on concrete, grout, mortar, and other cement-containing products produced by or
- 27 for Contractor for incorporation into the work during the construction of the Project for
- 28 compliance with the Contract Documents.
- 29 1. Strength tests using the following procedures:
- 30 a. Secure concrete samples in accordance with ASTM C172. Obtain each sample from a
- 31 different batch of concrete on a random basis, avoiding selection of test batch other
- 32 than by a number selected at random before commencement of concrete placement.
- 33 b. For each strength test mold and cure 5 (five) cylinders from each sample in accordance
- 34 with ASTM C31. Record any deviations from requirements on test report.
- 35 c. Field cure one cylinder for the 7-day test. Laboratory cure the remaining.
- 36 d. Test cylinders in accordance with ASTM C39. Test two cylinders at 28 days for
- 37 strength test result and field-cured sample at 7 days for information. Hold remaining 2
- 38 cylinder in reserve.
- 39 1) Strength test result: Average of strengths of two cylinders from the same sample
- 40 tested at 28 days. If one or more cylinders in a test manifest evidence of improper
- 41 sampling, molding, handling, curing, or testing, discard and test reserve cylinder;
- 42 average strength of remaining cylinders shall be considered strength test result.
- 43 Should all cylinders in a test show any of above defects, discard entire test.
- 44 2. Frequency shall be as follows:
- 45 a. Concrete sand cement grout; one strength test consisting of 3 IN DIA x 6 IN high
- 46 cylinders for each 4 HR period of grout placement or fraction thereof.
- 47 b. Cast-in-place concrete; one strength test consisting of 6 IN DIA x 12 IN high cylinders
- 48 for each 10 CY of each type of concrete or fraction thereof placed.

- 1 c. All other concrete; one strength test to be taken not less than once a day, nor less than
2 once for each 60 CY or fraction thereof for each mix type placed in any 1 day.
3 1) If total volume of concrete on project is such that frequency of testing required in
4 above paragraph will provide less than five strength tests, tests shall then be made
5 from at least five randomly selected batches or from each batch if fewer than five
6 batches are provided.
- 7 D. Determine slump of concrete sample for each load of concrete. Take sample as specified in
8 ASTM C94. Determine slump in accordance with ASTM C143.
- 9 E. Determine air content of concrete sample for each strength test in accordance with either ASTM
10 C231, ASTM C173, or ASTM C138. Take sample as specified in ASTM C94.
- 11 F. Determine temperature of concrete sample for each strength test.

12 **3.2 OTHER AS-NEEDED TESTING SERVICES**

- 13 A. Following services to be performed by Testing Agency when necessary and paid for by
14 Contractor at his own expense:
- 15 1. Additional testing and inspection required because of changes in materials or proportions
16 requested by Contractor.
- 17 2. Additional testing of materials or concrete occasioned by their failure, by test or inspection,
18 to meet Specification requirements.
- 19 3. Perform strength test on any concrete to which water has been added at the jobsite.
- 20 4. Other testing services needed or required by Contractor, such as field cured test specimens
21 for determining when forms, form shoring, or reshoring may be removed.
- 22 a. An extra strength test is required for concrete subject to either live load or shore
23 removal prior to 28 days after placing concrete.

24 **3.3 DUTIES AND AUTHORITIES OF TESTING AGENCY**

- 25 A. Testing Agency to inspect, sample and test materials and production of concrete as required by
26 these Contract Documents and by Engineer. When it appears that any material furnished or work
27 performed by Contractor fails to fulfill requirements of the Contract Documents, Testing Agency
28 to report such deficiency to Engineer and Contractor.
- 29 B. Testing Agency to report all test and inspection results to Engineer and Contractor immediately
30 after they are performed. All test reports to include exact location in the work at which batch
31 represented by a test was deposited. Reports of strength tests to include detailed information on
32 storage and curing of specimens prior to testing.
- 33

1 **3.4 RESPONSIBILITIES AND DUTIES OF CONTRACTOR**

- 2 A. Provide and fund all necessary testing services for qualification of proposed materials and
3 establishment of concrete mix designs.
- 4 B. Use of Testing Agency and approval by Engineer of proposed concrete mix design shall in no
5 way relieve Contractor of responsibility to furnish materials and construction in full compliance
6 with Contract Documents.
- 7 C. To facilitate testing and inspection, perform the following:
- 8 1. Furnish any necessary labor to assist Testing Agency in obtaining and handling samples at
9 site or other sources of materials.
- 10 2. Provide and maintain for sole use of Testing Agency adequate facilities for safe storage and
11 proper curing of concrete test specimens on site as required by ASTM C31.
- 12 D. Notify Engineer and Testing Agency sufficiently in advance of operations (minimum of 24
13 HRS) to allow for completion of quality tests and for assignment of personnel.

14 **3.5 EVALUATION OF TEST RESULTS**

- 15 A. Test results for standard molded and cured test cylinders to be evaluated separately for each mix
16 design. Such evaluation shall be valid only if tests have been conducted in accordance with
17 specified quality standards. For evaluation of potential strength and uniformity, each mix design
18 shall be represented by at least three strength tests. A strength test shall be the average of at least
19 two cylinders from the same sample tested at 28 days.
- 20 B. Acceptance:
- 21 1. Strength level of each specified compressive strength shall be considered satisfactory if both
22 of the following requirements are met:
- 23 a. Average of all sets of three consecutive strength tests equal or exceed the required
24 specified 28-day compressive strength.
- 25 b. No individual strength test falls below the required specified 28-day compressive
26 strength by more than 500 psi.
- 27 2. Field cured cylinders shall have compressive strengths of at least 85% of that obtained from
28 a corresponding laboratory cured specimen at same age. If this strength cannot be met,
29 Engineer shall have the right to direct additional field curing methods and/or other
30 corrective measures.

31 **3.6 TESTING OF CONCRETE-IN-PLACE**

- 32 A. In-place testing of concrete may be required by Engineer when strength of structure is
33 considered potentially deficient as specified in paragraph 3.7 D.
- 34 B. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by
35 Engineer to determine relative strengths at various locations in structure or for selecting areas to
36 be cored. Such tests shall not be used as the basis for acceptance or rejection.
- 37 C. Core Tests:
- 38 1. Where required, obtain and test cores in accordance with ACI 318 and ASTM C42. If
39 concrete in structure will be dry under service conditions, air dry cores (temperature 60 to
40 80 DegF, relative humidity less than 60 percent) for 7 days before test and test dry. If
41 concrete in structure will be wet or subjected to high moisture atmosphere under service
42 conditions, test cores after immersion in water for at least 40 HRS and test wet. Testing wet
43 or dry to be determined by Engineer.
- 44 2. Take three representative cores from each member or area of concrete in place that is
45 considered potentially deficient. Location of cores shall be determined by Engineer so as to
46 least impair strength of structure. If, before testing, one or more of cores shows evidence of
47 having been damaged subsequent to or during removal from structure, damaged core shall
48 be replaced.

- 1 3. Concrete in area represented by a core test will be considered adequate if average strength
- 2 of three cores is equal to at least 85 percent of specified strength and no single core is less
- 3 than 75 percent of specified strength.
- 4 4. Fill core holes with nonshrink grout. Finish to match surrounding surface when exposed in
- 5 a finished area.

6 3.7 ACCEPTANCE

- 7 A. Completed concrete work which meets applicable requirements will be accepted without
- 8 qualification.
- 9 1. Completed concrete work which fails to meet one or more requirements but which has been
- 10 repaired to bring it into compliance will be accepted without qualification.
- 11 2. Completed concrete work which fails to meet one or more requirements and which cannot
- 12 be brought into compliance may be accepted or rejected as provided in these Contract
- 13 Documents. In this event, modifications may be required to assure that concrete work
- 14 complies with requirements. Modifications, as directed by Engineer, to be made at no
- 15 additional cost to Owner.
- 16 B. Dimensional Tolerances:
- 17 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be
- 18 considered potentially deficient in strength and subject to modifications required by
- 19 Engineer.
- 20 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be
- 21 rejected and excess material subject to removal. If removal of excess material is permitted,
- 22 accomplish in such a manner as to maintain strength of section and to meet all other
- 23 applicable requirements of function and appearance.
- 24 3. Concrete members cast in wrong location may be rejected if strength, appearance or
- 25 function of structure is adversely affected or misplaced items interfere with other
- 26 construction.
- 27 4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed
- 28 to view, may be rejected. Repair or remove and replace if required.
- 29 5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or
- 30 appearance is not adversely affected. High spots may be removed with a grinder, low spots
- 31 filled with a patching compound, or other remedial measures performed as permitted or
- 32 required.
- 33 C. Appearance:
- 34 1. Concrete surfaces exposed to view with defects which, in opinion of Engineer, adversely
- 35 affect appearance as required by specified finish shall be repaired by approved methods.
- 36 2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in
- 37 the opinion of the Engineer, the defects impair the strength or function of the member.
- 38 D. Strength:
- 39 1. Strength of structure in-place will be considered potentially deficient if it fails to comply
- 40 with any requirements which control strength of structure, including but not necessarily
- 41 limited to following:
- 42 a. Low concrete strength as specified in Article 3.5.
- 43 b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at
- 44 variance with requirements of the Contract Drawings or approved shop drawings.
- 45 c. Concrete which differs from required dimensions or location in such a manner as to
- 46 reduce strength.
- 47 d. Curing time and procedure not meeting requirements of these Specifications.
- 48 e. Inadequate protection of concrete from extremes of temperature during early stages of
- 49 hardening and strength development.
- 50 f. Mechanical injury, construction fires, accidents or premature removal of formwork
- 51 likely to result in deficient strength.
- 52 g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely
- 53 to result in deficient strength.

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2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.
3. Core tests may be required when strength of concrete in place is considered potentially deficient.
4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with Chapter 20 of ACI 318.
5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Engineer, at Contractor's expense.
6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

END OF SECTION

1 **SECTION 03308**
2 **CONCRETE, MATERIALS AND PROPORTIONING**

3 **PART 1 - GENERAL**

4 **1.1 SUMMARY**

- 5 A. Section Includes:
- 6 1. Concrete materials, strengths and proportioning for concrete work.
 - 7 2. Grouting:
 - 8 a. Base plates for columns and equipment.
 - 9 b. Dowels and anchors into concrete.
 - 10 c. Patching cavities in concrete.
 - 11 d. As specified and indicated in the Contract Document.
- 12 B. Related Sections include but are not necessarily limited to:
- 13 1. Section 03311 - Concrete Mixing, Placing, Jointing, and Curing.
 - 14 2. Section 03348 - Concrete Finishing and Repair of Surface Defects.
 - 15 3. Section 03350 - Testing.

16 **1.2 QUALITY ASSURANCE**

- 17 A. Referenced Standards:
- 18 1. American Concrete Institute (ACI):
 - 19 a. 116R, Cement and Concrete Terminology.
 - 20 b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass
21 Concrete.
 - 22 c. 212.3R, Chemical Admixtures for Concrete.
 - 23 d.
 - 24 e. 226.3R, Use of Fly Ash in Concrete.
 - 25 f. 318, Building Code Requirements for Structural Concrete.
 - 26 2. American Society for Testing and Materials (ASTM):
 - 27 a. C33, Standard Specification Concrete Aggregates.
 - 28 b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 29 c. C94, Standard Specification for Ready-Mixed Concrete.
 - 30 d. C138, Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of
31 Concrete.
 - 32 e. C143, Standard Method of Test for Slump of Portland Cement Concrete.
 - 33 f. C173, Standard Method of Test for Air Content of Freshly Mixed Concrete by the
34 Volumetric Method.
 - 35 g. C192, Standard Practice for Making and Curing Concrete Test Specimens in the
36 Laboratory.
 - 37 h. C231, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure
38 Method.
 - 39 i. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - 40 j. C494, Standard Specification for Chemical Admixtures for Concrete.
 - 41 k. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for
42 Use as a Mineral Admixture in Concrete.
 - 43 l.
 - 44 3. Florida Department of Transportation Standard Specifications for Road and Bridge
45 Construction, 2004 Edition with Supplementals.
 - 46 4. Corps of Engineers Specification:
 - 47 a. CRD-C621, Standard Specification for Non-Shrink Grout.

48 **1.3 DEFINITIONS**

- 49 A. Words and terms used in these Specifications are defined in ACI 116R.

- 1 B. Trap Rock: Coarse aggregate of increased hardness and durability, fine-grained igneous rock (see
- 2 2.2F).
- 3 C. Grout: Sand-cement grout per paragraph 2.2.

4 **1.4 SUBMITTALS**

- 5 A. Shop Drawings:
- 6 1. Product technical data including:
- 7 a. Acknowledgement that products submitted meet requirements of standards referenced.
- 8 b. Manufacturer's instructions.
- 9 c. Concrete mix designs as required by Section 03350.
- 10 1) Manufacturer and type of proposed admixtures.
- 11 2) Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.
- 12 3) Mill certificates for cement and fly ash.
- 13 2. Certifications:
- 14 a. Certification of standard deviation value in PSI for ready mix plant supplying the concrete.
- 15 b. Certification that the pozzolan meets the quality requirements stated in this Section, and
- 16 supplier's certified test reports for each shipment delivered to concrete supplier.
- 17 c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for
- 18 type and location of concrete construction.
- 19 1) Documentation for special coarse aggregate (trap rock).
- 20 d. Certification of aggregate gradation.
- 21 3. Test reports:
- 22 a. Cement mill reports for all cement to be supplied.

23 **1.5 DELIVERY, STORAGE AND HANDLING**

- 24 A. Storage of Materials:
- 25 1. Store cement and pozzolan in weathertight buildings, bins, or silos which will exclude moisture
- 26 and contaminants.
- 27 2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent
- 28 contamination with other materials or with other sizes of like aggregates.
- 29 3. Allow natural sand to drain until it has reached a relatively uniform moisture content before
- 30 use.
- 31 4. Do not use frozen or partially frozen aggregates.
- 32 5. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.
- 33 a. For those used in form of suspensions or non-stable solutions, provide agitating equipment
- 34 to assure thorough distribution of ingredients.
- 35 b. Protect liquid admixtures from freezing and temperature changes which would adversely
- 36 affect their characteristics and performance.

37 **PART 2 - PRODUCTS**

38 **2.1 ACCEPTABLE MANUFACTURERS**

- 39 A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
- 40 1. Non-shrink grout:
- 41 a. Master Builders.
- 42 b. Gifford Hill.
- 43 c. U. S. Grout.
- 44 d. Upco.
- 45 e. Set Products, Inc.
- 46 f. L & M Construction Chemicals, Inc.
- 47 g. Sika.
- 48 2. Epoxy grout:
- 49 a. Ceilcote.
- 50 b. Exxon Chemical Co.
- 51 c. Sika.
- 52 d. U.S. Grout.

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2 B. Submit requests for substitution to Engineer of Record.

3 **2.2 MATERIALS**

4 A. Cement:

- 5 1. ASTM C150, Type I/II.
6 2. Cement type used shall correspond to that upon which selection of concrete proportions was
7 based in the mix design.

8 B. Fly Ash:

- 9 1. ASTM C618, Class F.
10 2. Non-staining.
11 3. Suited to provide hardened concrete of uniform light gray color.
12 4. Maximum loss on ignition: 4 percent.
13 5. Compatible with other concrete ingredients and having no deleterious effects on the hardened
14 concrete.
15 6. Produced by source approved by the State of Florida Highway Department for use in concrete
16 for bridges.
17 7. Cement and fly ash type used shall correspond to that upon which selection of concrete
18 proportions was based in the mix design.

19 C. Admixtures:

- 20 1. Air entraining: ASTM C260.
21 2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and
22 provisions of ACI 212.3R.
23 3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
24 4. Pozzolanic: ASTM C618.
25 5. Admixtures to be chloride free. Do not use calcium chloride.
26 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required
27 concrete proportions in the mix design.
28 7. Pozzolan or other additives shall not be used to compensate for alkali reactivity of aggregates.

29 D. Water:

- 30 1. Potable.
31 2. Clean and free from deleterious substances.
32 3. Free of oils, acids and organic matter.

33 E. Aggregates for Normal Weight Concrete:

- 34 1. ASTM C33.
35 2. Fine and coarse aggregates to be regarded as separate ingredients.
36 3. Fine aggregates to be natural, not manufactured.
37 4. Coarse aggregate sieve analysis unless otherwise noted:
38 a. Concrete specified as 6000 PSI shall utilize trap rock coarse aggregate, ASTM C33 Size
39 number 57, complying with the following:
40 1) Specific gravity: 2.80 (min) for bulk SSD condition.
41 2) Maximum 14.0% abrasion loss according to ASTM C131, Grading B.
42 b. For all concrete: ASTM C33, size number 67 (maximum 3/4 IN).
43 5. Provide aggregates approved for bridge construction by the Florida Department of
44 Transportation.

45 F. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight
46 percent of cement:

- 47 1. 0.10 for all concrete.

48 G. Sand Cement Grout:

- 49 1. Approximately 3 parts sand, 1 part portland cement, 6 plus/minus 1 percent entrained air and
50 water to produce a slump which allows grout to completely fill required areas and surround
51 adjacent reinforcing.
52 a. Provide sand in accordance with requirements for fine aggregate for concrete.

- 1 2. Minimum 28-day compressive strength: 3000 PSI, or the compressive strength of the concrete
2 receiving the grout as a construction joint bonding layer.
- 3 H. Non-shrink Grout:
- 4 1. Non-shrink, non-metallic, non-corrosive, and non-staining.
- 5 2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
- 6 3. Grout to produce a positive but controlled expansion. Mass expansion shall not be created by
7 gas liberation or by other means.
- 8 4. Minimum 28-day compressive strength: 6500 PSI.
- 9 5. Master Builders "Special LL-713 Grout"; Gifford-Hill "Supreme Grout"; Sauereisen Cements
10 "F-100 Level Fill Grout"; U S Grout "Five Star Grout"; Set Products, Inc. "Set Non-Shrink
11 Grout"; The Upco Corp "Upcon"; L & M "Crystex"; Sika Corporation "Sika Grout 212"; or
12 equal.
- 13 6. In accordance with CRD-C621.
- 14 I. Epoxy Grout:
- 15 1. Three-component epoxy resin system:
- 16 a. Two liquid epoxy components.
- 17 b. One inert aggregate filler component.
- 18 2. Adhesive:
- 19 a. Ceilcote "HT648" grout.
- 20 b. Exxon Chemical Company "Escoweld 2505."
- 21 c. Sika "Sikadur Hi-Mod."
- 22 d. U S Grout "Five Star Epoxy Grout."
- 23 e. Or equal.
- 24 3. Aggregate:
- 25 a. Ceilcote "HT648."
- 26 b. Exxon Chemical Company "Escoweld 2510."
- 27 c. Sika aggregate.
- 28 d. U S Grout aggregate.
- 29 e. Or equal.
- 30 4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
- 31 5. The aggregate shall be compatible with the adhesive.
- 32 6. Each component furnished in separate package for mixing at job site.

33 **2.3 MIXES**

- 34 A. General:
- 35 1. Provide concrete capable of being placed without aggregate segregation and, when cured, of
36 developing all properties specified.
- 37 2. Ready-mixed concrete shall conform to ASTM C94.
- 38 3. All concrete to be normal weight concrete, weighing approximately 145 to 150 LBS per cubic
39 foot at 28 days after placement.
- 40 4. Blend in all components and additives at batch plant.
- 41 5. All permanently exposed concrete shall have synthetic fibers in mix.
- 42 B. Minimum 28-Day Compressive Strengths:
- | | |
|-----------------------------------|------|
| 1. Transfer Station Tipping Floor | 6000 |
| 2. All other concrete | 3000 |
- 43 C. Air Entrainment:
- 44 1. Provide air entrainment in all concrete resulting in a total air content percent by volume as
45 follows:
- 46 a. 3/4 and 1 IN maximum aggregate size: 6 percent maximum total air content.
- 47 b. 1/2 IN maximum aggregate size: 7 percent maximum total air content.
- 48 D. Slump:
- 49 1. 4 IN max, 1 IN min measured at point of discharge into all concrete construction.

2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. 8 IN maximum after addition of superplasticizer (reference "Proportioning" paragraph).
4. Provide HRWRA at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and observe maximum water to cement ratios.

E. Proportioning:

1. General:
 - a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
 - b. Proportion ingredients to produce proper placability, durability, strength and other required properties.
2. Normal weight concrete cement contents and maximum water cement ratios:

SPECIFIED STRENGTH (PSI)	TARGET CEMENT CONTENT (SACKS/CY)	TARGET CEMENT (LBS/CY)	MAXIMUM WATER CEMENT RATIO BY WEIGHT
6000	7	658*	0.38 (superplasticizer required)

* The weight of fly ash plus weight of portland cement shall equal these values.

3. Pozzolans:
 - a. Fly ash is required for all 6000 PSI cast-in-place concrete, a maximum of 20 percent by weight of portland cement content per cubic yard shall be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
 - b.
 - c. Where fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Section.
 - d.
4. Water reducing, retarding, and accelerating admixtures:
 - a. Use in accordance with manufacturer's instructions.
5. High range water reducers (superplasticizers):
 - a. Use in accordance with manufacturer's instructions.
 - b. Maximum concrete slump before addition of admixture to be 3 IN. Maximum slump after addition to be 8 IN.
 - c. Required in 6000 PSI concrete.
6. Concrete mix proportioning methods for normal weight concrete:
 - a. Method 1:
 - 1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
 - 2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.
 - 3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 percent specified.
 - 4) For each water cement ratio or cement content, make at least three compression test cylinders for specified test age, and cure in accordance with ASTM C192. Test for strength at 28 days in accordance with ASTM C39.
 - 5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.
 - 6) From this curve select water cement ratio or cement content to be used to produce required average strength.
 - 7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.

- 1 8) Base field control on maintenance of proper cement content, slump, air content and
2 water cement ratio.
3 9) See paragraph hereafter for definition of required average strength.
4 b. Method 2:
5 1) In lieu of trial mixes, field test records for concrete made with similar ingredients may
6 be used.
7 2) Use of proposed concrete mix proportions based on field test records subject to
8 approval by Engineer based on information contained in field test records and
9 demonstrated ability to provide the required average strength.
10 3) Field test records to represent materials, proportions and conditions similar to those
11 specified. Changes in the materials, proportions and conditions within the test records
12 shall have not been more restricted than those for the proposed concrete mix.
13 4) Field test records to consist of less than 30 but not less than 10 consecutive tests
14 provided the tests encompass a period of not less than 45 consecutive days.
15 5) Required concrete proportions may be established by interpolation between the
16 strengths and proportions of two or more test records each of which meets the
17 requirements of this Section.
18 7. Required average strength:
19 a. Required average strength to exceed the specified 28-day compressive strength by the
20 amount determined or calculated in accordance with paragraph 5.3 of ACI 318 using the
21 standard deviation of the proposed concrete production facility as described in paragraph
22 5.3.1 of ACI 318.

23 **2.4 SOURCE QUALITY CONTROL**

- 24 A. To assure stockpiles are not contaminated or materials are segregated, perform any test for
25 determining conformance to requirements for cleanness and grading on samples secured from
26 aggregates at point of batching.
27 B. Do not use frozen or partially frozen aggregates.

28 **PART 3 - EXECUTION**

29 **3.1 FIELD QUALITY CONTROL**

- 30 A. Perform concrete tests per Section 03350.
31 B. Perform strength test on any concrete to which water has been added at the jobsite.

32 **END OF SECTION**