

SECTION 03300 - CAST- IN - PLACE CONCRETE**PART 1 GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing.
- B. Related Sections include, but are not limited to:
 - 1. Section 01732 - Selective Demolition.
 - 2. Section 04810 - Unit Masonry.
 - 3. Section 05310 - Steel Deck.
 - 4. Section 05520 - Aluminum Handrails & Railings.
 - 5. Section 06100 - Rough Carpentry.
 - 6. Section 07190 - Water Repellents.

1.3 SUBMITTALS

- A. Product Data: Submit data for each type of product and material indicated including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, vapor barriers, and others as requested by Architect/Engineer. Substitutions for specified items or manufacturers are to be submitted in accordance with Division 1 and will be subject to approval, rejection or other appropriate action.
- B. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
- C. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
- D. Samples of materials as requested by Architect/Engineer, including names, sources, and descriptions, as follows:
 - 1. Normal weight aggregates.
 - 2. Reglets.
 - 3. Water stops.
 - 4. Vapor retarder/barrier.
- E. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

Substantiating data to be no older than one year from date of submittal.

- F. Laboratory test reports for concrete materials and mix design test.
- G. Material certificates in lieu of material laboratory test reports when permitted by Architect/Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements. Materials include:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Semirigid joint filler.
 - 11. Joint-filler strips.
 - 12. Repair materials.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 & 347 and Florida Building Code, 2007 Edition.
 - 1. Design or utilize standard metal forms to permit removal without destroying the edges, shapes, and faces of concrete.
 - 2. Coordinate formwork construction to ensure provision if openings, blockouts, inserts, reglets, piping, conduit, etc., required for the work of other trades.
 - 3. Maintaining vertical plumbness within required tolerances is critical, deviation from this requirement will not be tolerated.
- B. Comply with requirements of Florida Threshold Building Law and Florida Building Code, 2007 Edition.
- C. Perform concrete reinforcing work in accordance with ACI 301, ACI 318, CRSI 63, 65, and Manual of Practice, ASTM A184.
- D. Perform cast-in-place concrete work in accordance with ACI 301, ACI 318, ACI 304, ACI 305, and ACI 306.
- E. Concrete Testing Service: Owner shall select testing agency acceptable to Architect/Engineer to perform material evaluation tests.
- F. Test quality of concrete at the chute for slump and air content for each truck as indicated in the Drawings. See paragraph 3.10 for additional requirements.
- G. Make Compressive Strength Cylinders each day in accordance with ASTM C39, one set of **six**

standard cylinders for each compressive strength tests, moist cure, and test at laboratory. See paragraph 3.10 for additional requirements.

- I. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.
- J. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. Submit written evidence of at least ten such projects.
 - 1. Submit written evidence that flatwork placer/finisher has not less than (3) years continuous experience and a minimum of (5) projects in the successful placement and finishing of concrete slabs with flatness and levelness requirements equal to or higher than those specified for this project.
- K. Manufacturer Qualifications: A firm experienced in the successful manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production and delivery, facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities. Submit certification.
- L. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

1.5 DELIVERY AND STORAGE

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Steel reinforcement stored at the work site shall be placed on platforms, skids, or other supports and in a manner that contact with the ground is avoided and be protected from mechanical damage and/or corrosion.
- C. Water stops: Store water stops (specified in Section 07170) under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.6 COORDINATION

- A. General: It is the Contractor's sole responsibility to coordinate with all trades for the setting of sleeves, anchor bolts, dovetail slots, inserts, frames, flashing, reglets, pipes, ducts and other embedded items and provide all openings required for installation of other work in accordance with the Contractor's shop drawings and the Contract Documents.
- B. Structural Integrity: Provide no sleeves or openings in structural members unless shown on the structural drawings or approved by the Architect/Engineer.

- C. Inspection: Architect/Engineer may inspect formwork at any time and may reject formwork if forms do not conform to the lines, levels, and tolerances as required in this Section, the shop drawings or the Design Drawings. If formwork is rejected, the Contractor must repair or replace the rejected portion with no additional cost to the Owner.

PART 2 PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

- A. Plywood: PS 1, MDO Grade ; 5/8-inch minimum, sound undamaged sheets with clean true edges.
- B. Lumber: Douglas Fir, construction grade; Southern Pine #2 grade.
- C. Prefabricated Steel or Glass-fiber-reinforced plastic type: matched, tight fitting, stiffened to support weight of concrete.
- D. Pan Type: Steel; of size and profile required.
- E. Tubular Column Type: Round, spirally wound laminated materials, inside surface treated with release agent, of size required.
- F. Form Ties: Snap-off metal type of fixed length, cone type.
 - 1. Form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1-inch in diameter in concrete surface.
 - 3. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.
- G. Form Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- H. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile, knockout holes to receive doweling.
- I. Slab Edge/Expansion Joint Filler: Premolded expansion joint filler strips, ASTM D1751-99, or resin impregnated fiberboard conforming to the physical requirements of ASTM D1752-84. Size and location as indicated in the Drawings.
- J. Vapor Retarder: 10 mil thick, ASTM 1745 - Class A, type recommended for below grade application. Include manufacturer's recommended adhesive or pressure sensitive joint tape.
- L. Nails, Spikes, Lag Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel Bars, stirrups and column ties: ASTM A615, 60 ksi yield grade; deformed new billet steel bars.
- B. Welded Steel Wire Fabric: ASTM A185 Plain type, in mats, sizes and gages scheduled in the Drawings.
- C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing.
 - 1. For concrete surfaces exposed to view where legs of wire supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
- D. Tie Wires: Annealed and of sufficient strength for intended purpose, minimum 16 ga, ASTM A82.
- E. Accessories for flat slabs shall be placed in accordance with ACI-315.
 - 1. Reinforcement chairs shall be plastic or stainless steel.
- F. Fabricate concrete reinforcing in accordance with ACI 315, ACI 318, ASTM A184, and CRSI Manual.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Normal-Type I OR III, Portland type, air entrained as indicated in mix submittals.
 - 1. Use one brand of cement unless otherwise acceptable to Architect/Engineer.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Admixtures: **Admixtures containing chloride ions are not permitted.**
 - 1. Air Entrainment Admixture: ASTM C260.
 - 2. Chemical, Type D, ASTM C494, Water Reducing Admixture.
- E. Bonding Agent: Two component modified epoxy resin.
- F. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

2.4 COMPOUNDS, HARDENERS AND SEALERS

- A. Dissipating Curing Compound: ASTM C309, Type 1D, 30% solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm. when applied at a rate of 300 sq. ft. per gallon. Manufacturer certification required. The curing compound shall not contain calcium chlorides.
 - 1. Certified by curing compound manufacturer to not interfere with the bonding of floor covering.

- B. Non-Metallic Hardener: Sodium silicate free, pre-mixed emery product. Dry-shake application.
- C. Sealer: colorless type, according to FS TT-C-800.

2.5 CONCRETE MIX

- A. Mix and deliver ready-mix concrete in accordance with ASTM C94.
- B. Provide concrete of strengths as indicated on the structural drawings.
- C. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as indicated in the Drawings.
- D. Select admixture proportions for normal weight concrete in accordance with ACI 301 and ACI 318.
- E. Add air entraining agent to concrete mix for concrete work exposed to exterior.

2.6 CONCRETE PRODUCTION

- A. General: As per ACI 301, Section 4, Article 4.3, except as noted.
- B. Ready-Mixed Concrete: Use for all work, except that when small quantities (not over 1/2 cu yd) are needed for isolated or relatively unimportant items, concrete may be batch mixed at site, subject to Architect/Engineer's prior approval.
- C. Delivery Ticket: In addition to information required on the delivery ticket in ASTM C94, the following data regarding water, expressed in gal./cu yd, shall be shown on the delivery ticket or on an attached batch ticket for each truckload of concrete:
 - 1. Mix design water requirement.
 - 2. Free water in aggregate.
 - 3. Water added at plant.
 - 4. Permissible water to add at job site.
- D. Mixing Time: Tickets shall be stamped when the concrete is batched. The maximum time allowed from the time the mixing water is added until it is deposited in its position shall not exceed one and one half hours. Concrete not placed within this time shall be discarded.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

- A. Erect formwork to achieve design requirements. Assemble formwork to permit dismantling so that concrete is not damaged during its removal. Conform to ACI 347, Chapter 2.
- B. Provide bracing to ensure stability of formwork.
- C. Provide temporary ports in formwork to facilitate cleaning and inspection. Allow water to drain.

- D. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.
- E. Do not apply form release agent where concrete surfaces will receive applied coverings which are affected by agent.
- F. Clean forms as erection proceeds, to remove foreign matter.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Provide no sleeves or openings in structural members unless shown on the structural drawings or approved by the Architect/Engineer.
- C. Install concrete accessories straight, level, and plumb.
- D. Do not displace or damage vapor barrier. Replace or reposition vapor barrier as required.
- E. Install void forms in accordance with manufacturer's instructions. Protect forms from moisture before concrete placement and from crushing during concreting.

3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Reinforcing steel in walls and beams, unless otherwise noted (u.o.n.), continuous throughout length of the member. Splices shall not occur at critical sections and shall be approved by Structural Engineer.
- C. Reinforcing steel continuous through all construction joints, u.o.n.
- D. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.
- E. Maintain steel in a clean and serviceable condition protected from damage until it is completely embedded within the concrete.
- F. Protect metal reinforcement by concrete cover as indicated in the Structural drawings and in accordance with CRSI Manual.
- G. Splice bars as indicated in the Drawings.
- H. Wire Fabric: Minimum lap splice length shall be one mesh spacing plus two inches. Mesh shall be supported by plastic chairs and located at one third depth from top of slab.

3.4 PLACING CONCRETE

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.
- B. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches and seal watertight. Repair damaged vapor retarder with vapor retarder material, lap over damaged areas minimum 6 inches and seal watertight.
- C. Before casting concrete, check that all reinforcing conforms to contract and approved shop detail drawings and specification requirements. Comply with ACI 304.
- D. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- F. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
 - 1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 3. Maintain reinforcing in proper position on chairs during concrete placement.
- G. Place concrete continuously between predetermined expansion, control and construction joints.
- H. When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
- I. Screed floors and slabs-on-grade level.

3.5 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

- B. Remove formwork progressively and in accordance with code requirements.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.6 FINISH TOLERANCES

- A. Tolerances for Formed Surfaces: Unless otherwise specified or noted on the Drawings, conform to the requirements given below or as given in ACI 117, whichever is more stringent. All tolerances shall apply to the full height of the building. Variations from grade shall be measured prior to removal of formwork.
 - 1. Vertical Variation from plumb:
 - In the lines and surfaces of columns, piers, walls, corners and the like:
 - In any 10 ft. of length.....1/8 in.
 - Maximum for the entire height..... 1/2 in.
 - For exposed corner columns, control-joint grooves, and other conspicuous lines:
 - In any 20 ft. of length.....1/4 in.
 - Maximum for the entire height.....1/2 in.
 - 2. Alignment:
 - At slab and/or beam, alignment of columns or walls above and below:
 - Maximum offset.....1/4 in.
 - 3. Variation from level or specified grades and elevations:
 - In slab, beam and girder soffits and the like:
 - In any 10 ft. length.....1/4 in.
 - In any bay or in any 20 ft. length.....3/8 in.
 - Maximum for the entire length.....3/4 in.
 - In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
 - In any bay or in 20 ft. length.....1/4 in.
 - Maximum for the entire length.....1/2 in.
 - 4. Variation of building lines from theoretical positions in plan and related positions of columns, walls, piers and the like:
 - In any bay.....1/4 in.
 - In any 20 ft. length.....1/4 in.
 - Maximum for the entire length.....1/2 in.
 - 5. Sleeves, wall openings and floor openings:
 - Variation in size.....1/4 in.
 - Variation in location.....1/2 in.
 - 6. Variation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
 - Minus.....1/4 in.
 - Plus.....1/2 in.
 - 7. Variation in the location of anchors and inserts shown in accepted shop drawings, unless more stringent tolerances are required for work of other Sections:
 - Vertically.....3/8 in.
 - Horizontally.....1/4 in.
 - 8. Faces of formed slab edges, turned down spandrels, and parapets shall not deviate from theoretical position or alignment by more than the distance in consideration divided by 500 or

- by 1/2 inch, whichever is less.
- 9. Footings:
 - Variations in dimensions in plan:
 - Minus.....1/2 in.
 - Plus.....2 in.
 - Misplacement or eccentricity:
 - 2 percent of the footing width in direction of misplacement but not more than.....2 in.
 - Thickness:
 - Decrease in specified thickness.....5 percent
 - Increase in specified thickness.....No limit
 - Elevation at steel bearing plates:
 - Plus.....1/4 in.
 - Minus.....1/4 in.
- 10. Variation in stair dimensions:
 - In a flight of stairs:
 - Rise.....1/8 in.
 - Run.....1/4 in.
 - In consecutive steps:
 - Riser.....1/16 in.
 - Tread.....1/8 in.

3.7 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301. Finish concrete to degree required for installation of each floor finish material.
- B. Uniformly spread, screed, and float concrete.
- C. Steel trowel all floor surfaces.
- D. Trowel and Fine (Light) Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom in the following locations:
 - 1. Where ceramic or quarry tile is to be installed with thin-set mortar,
 - 2. Where waterproofing or traffic coating is to be applied to substrate,
 - 3. Any other surface/substrate so indicated on the drawings to receive a fine/light broom finish.
- E. Steel trowel surfaces which will receive carpeting; resilient flooring; thin set ceramic tile or which will be left exposed.
- F. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect/Engineer before application.
- G. Maintain surface flatness, with maximum variation of 1/4 inch in 10 ft.

- H. In areas with floor drains, maintain floor level at walls and slope surfaces uniformly to drains.
- I. Apply concrete hardener on floor surfaces as scheduled. Apply in accordance with manufacturer's instructions.
- J. Underside of concrete slabs to receive one coat or knock-down texture finish shall be free of depressions and protrusions. Grind joints and high spots, fill low spots, to produce recommended flatness tolerances.. Apply bonding agent compatible with texture finish specified in Section 09220.

3.8 CURING

- A. Apply dissipating curing compound on floor surfaces in accordance with manufacturer's instructions.
- B. Immediately after placement, protect concrete from premature drying.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- D. Verify compatibility with finishes, i.e. Epoxy Seamless Flooring specified in Division 9.

3.9 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect/Engineer.
- B. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect/Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- C. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
 - 1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 - 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 - 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may

be used when acceptable to Architect/Engineer.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

3.10 FIELD QUALITY CONTROL

- A. General: The Owner will engage a testing agency to perform tests and to submit test reports. Contractor will pay for all testing services.
- B. Concrete Test Cylinders: cylinders shall be taken, made and tested in accordance with ASTM C 172, C 31 and C 39 respectively. Sets of six field control cylinder specimens are to be taken at random during the progress of the work. The total number of specimens taken shall average 1 set per 50 cubic yards of concrete poured each day, with a minimum of 1 set when less than 50 yards are poured. Test 1 cylinder at 3 days, 1 at 7 days, and 3 at 28 days. The sixth cylinder shall be held in reserve to be tested in 56 days if the 28 day tests do not meet the required strength. Send four copies of each test report to the Architect/Engineer for distribution.
- C. One (1) Additional Test Cylinder: Taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.
- D. One (1) Slump Test: Taken for each truck taken in accordance with ASTM C 143. Maximum slump shall be 4 to 6 inches.
- E. Air entrainment tests shall be made in accordance with ASTM C 231. The regularity of these tests shall be determined by the laboratory and the Architect/Engineer
- F. Test reports will be reported in writing to Owner, Ready-Mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project name, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- G. Architect/Engineer reserves the right to dispense with the services of any engineer or testing laboratory at any time and select any other testing laboratory or engineer to continue the work , if he believes it is in the interest of the Owner.
- H. Additional Tests: The testing service will perform additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Owner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.11 DEFECTIVE CONCRETE

- A. The average of any three consecutive strength tests of laboratory cured specimens representing each class of concrete shall be equal to or greater than the specified strength and no more than 10% of the strength tests shall have values less than the specified strength.
 - 1. No individual test shall be more than 500 psi below the specified strength.
 - 2. In the event failure to meet any of these requirements, the Architect/Engineer shall have the right to order additional moist curing of the concrete, or cylinder core tests in accordance with ASTM C 42 and load tests in accordance with ACI 31B.
 - 3. Cylinder core sample taking and testing, and any additional testing of defective concrete required by Architect/Engineer shall be paid by Contractor.

- B. Concrete which is unacceptable due to failure to comply with strength requirements shall be removed, reinforced or strengthened as directed by the Architect/Engineer, with no additional expense to the Owner.

- C. Whenever 28 day strength of test cylinders falls below the strengths specified for the concrete mixture, temperature and curing shall be changed as required by the Architect/Engineer at no additional cost to the Owner.

END OF SECTION 03300