

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

- A. Basic Specification: All work of this Section shall conform to the requirements of ACI 301. Numbers in parentheses (0.00) indicate a related paragraph of ACI 301.
- B. Work Included: All cast-in-place concrete work shown on the Drawings and required by these Specifications, including formwork, reinforcement, concrete materials, mix design, placement procedures and finishes. Allow for the installation of cast-in-place items furnished under other Sections
- C. Provide concrete pads, piers, and bases required for all trades, unless otherwise noted.
- D. Coordinate the work of other trades who are to provide and install items (sleeves, piping, conduit, inserts, etc.) to be cast in the concrete. Place no concrete until all such items are in place.
- E. Inspection and testing services required to establish mix designs are to be performed by an agency retained by the Contractor (1.6.3). Other services required by this Section are to be performed by an agency retained by the Contractor (1.6.4). Provide facilities for storage and curing of specimens molded by the Contractor's agency (1.6.3.2.d).
- F. Related Work Specified Elsewhere: The general provisions of the Contract apply to the work of this Section as though reproduced herein. Carefully examine all other Sections and all Drawings for related work; which includes but is not limited to:
 - 1. Unit Masonry - 04 20 00

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ACI 318, "Building Code Requirements for Structural Concrete."
 - 2. ACI Detailing Manual, 1994 (SP-66).
 - 3. ACI 347, "Guide to Formwork for Concrete."
 - 4. CRSI "Placing Reinforcing Bars," and "Manual of Standard Practice."
 - 5. ACI 305, "Hot Weather Concreting."
 - 6. ACI 306, "Cold Weather Concreting."
 - 7. "Ohio Department of Transportation Construction and Material Specifications", (ODOT CMS) 2008 edition.

- B. Materials and installed work may require testing and retesting at any time during the progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Rough Formed Finished Concrete: Plywood, lumber, metal or other approved material.
- B. Chamfer Strips: Wood, metal, PVC or rubber strips, 3/4 inch x 3/4 inch, minimum.

2.2 REINFORCING (3.2.1)

- A. Deformed Bars: ASTM A615 (including Supplementary Requirements) or A617. Minimum yield strength to be 60 ksi. Bars to be welded are to be per A706.
- C. Welded Wire Fabric: ASTM A185. Provide in sheet form (not rolls).
- D. Smooth Dowels: Meet the requirements of Section 709.13 of the ODOT CMS.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I, II, or III (4.2.1.1).
- B. Water: Potable.
- C. Aggregates: ASTM C33. Use size No. 57 coarse aggregate, unless otherwise indicated (4.2.1.2).

2.4 ADMIXTURES

- A. All admixtures shall be certified by the manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and shall be compatible with other admixtures and cementitious materials.
- B. Water-Reducing: ASTM C494, Type A or D.
- C. Superplasticizer: ASTM C494, Type F or G.
- D. Air-Entraining: ASTM C260.
- E. Accelerating: ASTM C494, Type C or E, containing no more chlorides than are present in municipal drinking water.
- F. Calcium chloride is not permitted (4.2.2.6).

2.5 RELATED MATERIALS

- A. Curing Compound: Comply with ASTM C309, Type 1, Class B (clear), except moisture loss not to exceed 0.39 kg/sq. m. in 72 hours. Compound shall comply with EPA's VOC requirements. Apply at the manufacturer's written recommended application rate. Must be compatible with adhesive specified for floor finishes or be removed by the Contractor prior to applying floor finish.
- B. Grout for Masonry Core Fill: ASTM C476, coarse type or fine type, placed per ACI 530.1, Paragraph 3.5.

2.6 CONCRETE MIXES

- A. The following classes of concrete are required (4.2.2.8):
 - 1. Class I – footings and piers: Minimum $f'_c = 3,000$ psi.
 - 2. Class II - interior slabs on grade and all interior concrete not otherwise identified. Minimum $f'_c = 3,500$ psi; water-reducer required. Minimum cement content 517 lbs. per cubic yard.
 - 3. Class III - exterior slabs on grade, basement walls and all exterior concrete not otherwise identified. Minimum $f'_c = 4,000$ psi; air-entraining admixture and water-reducer required. Maximum water-cement ratio: 0.48, air content: $5 \pm 1.5\%$ (4.2.2.4).
 - 4. Class IV - backfill below footings. Minimum $f'_c = 1,500$ psi (lean mix).
 - 5. Class V - fill on composite floor deck, fill in stair pans and treads. Minimum $f'_c = 3,500$ psi, with water-reducing admixture and #8 coarse aggregate. Minimum cement content 611 lbs. per cubic yard.
 - 6. Class VI - columns, beams and framed slabs. Minimum $f'_c = 4,000$ psi, water-reducer required. Minimum cement content 517 per cubic yard.
 - 7. Class VII – beams and framed slabs where indicated on the drawings. Minimum $f'_c = 5,000$ psi. Silica fume, air-entraining admixture and water-reducer and/or superplasticizer are required. Minimum cement content 611 lbs. per cubic yard. Minimum silica fume solids content 45 lbs. per cubic yard. Maximum water-cement ratio 0.40 (based on cement only). Air content $6 \pm 1.5\%$.
- C. Class IV concrete may be site mixed, all other concrete is to be ready-mixed (4.3.1.1 and 4.3.1.2). All admixtures are to be added at the batch plant, except that superplasticizer, if used, is to be added at the site.
- D. Slump (4.2.2.2):
 - 1. Design concrete mixes for a maximum slump of 4 inches, unless a superplasticizer is to be used.
 - 2. If a superplasticizer is to be used, design mixes for a slump of 2 inches - 3 inches before its addition; maximum slump permitted after its addition is 8 inches.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Verify that excavations are free of water and ice, are of the required dimensions and have been

approved by the Soils Engineer prior to placing concrete (5.3.1).

- B. Determine field conditions by actual measurement.
- C. Notify the A/E not less than 24 hours in advance of placing concrete. Place concrete only when the A/E is present, unless this requirement is specifically waived.

3.2 FORMWORK

- A. Footings may be cast against earth cuts when soil conditions permit (2.2.2.3).
- B. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
- C. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste. Chamfer all exposed corners and edges.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
- F. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Forms, shores and falsework for non-prestressed structural members such as beams, joists, slabs, columns, walls, etc. that support the weight of concrete shall remain in place until the concrete has attained 85% of the specified 28 day strength for beams and slabs and 50% of the specified 28 day strength for columns and walls. The determination of concrete strength shall be as set forth in ACI 301, Paragraph 2.3.4.
- H. It shall be solely the responsibility of the Contractor to remove the forms, shore and reshore in a manner which will ensure complete safety of the structure. The removal of the forms and supports, including the operations of reshoring shall follow the recommendations of ACI 347 "Guide To Formwork For Concrete," except as modified herein.

3.3 REINFORCING

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by A/E.

3.4 EMBEDDED ITEMS

- A. Install embedded conduit, pipes and sleeves subject to the following limitations:
 - 1. Do not embed aluminum without prior approval of coating material.
 - 2. Do not displace reinforcing steel.
 - 3. In slabs, limit outside dimension of conduits and pipes to 1/3 member thickness. Where conduits cross, maintain same minimum concrete cover as required for reinforcing bars. For slabs over metal decks, thickness is measured from the top of the metal deck.
 - 4. In columns, limit total area of pipes and conduit to 4% of column area.
 - 5. Maintain a center-to-center spacing of at least three diameters of conduit or pipe.
- B. Plates and Anchors: Set and build into work anchorage devices and other embedded items required for other work attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

3.5 DELIVERY AND PLACEMENT

- A. Preparation Before Placement:
 - 1. Remove all debris from forms and deck. Clean steel deck of grease, oil, and other substances which would reduce bond to concrete.
 - 2. Do not use additives or salts to remove ice.
 - 3. In cold weather, maintain temperature of forms and reinforcing such that concrete temperature can be kept within the specified range.
- B. Delivery:
 - 1. Conform to ASTM C94.
 - 2. ASTM C94 requires discharge within 1-1/2 hours or 300 revolutions, whichever occurs first, after the introduction of water to cement and aggregates, or the introduction of cement to the aggregates. The A/E may require an earlier discharge during hot weather or when high-early strength cement is being used (4.3.2.2).
 - 3. Place concrete at the maximum slump for which the mix was designed with a tolerance of up to 1 inch above the maximum.
- C. Placement:

TWIN VALLEY BEHAVIOR HEALTHCARE

1. Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete" and as specified herein.
2. Place within 6 feet of final position. Spreading with vibrators is prohibited.
3. In walls and columns, deposit concrete in uniform horizontal layers with a maximum depth of 2 feet.
4. Maximum free fall without chutes or elephant trunks to be 5 feet.

3.9 CURING AND PROTECTION

A. Temperature:

1. When the average air temperature is expected to be less than 40 degrees for more than three consecutive days, temperature of concrete as placed is to be between 50 and 90 degrees F (55 and 90 degrees F for sections less than 12 inches thick). Maintain concrete temperature within these limits for the full curing period of seven days. (4.2.2.7, 5.3.1.6, 5.3.2.1.b and 5.3.6.1).

B. Curing:

1. Interior slab areas which will receive finish in cementitious setting bed are to be moist-cured, without the use of a curing compound (5.3.6.4.a through 5.3.6.4.d).
2. Surfaces which are to receive a sealer are to be moist-cured, without the use of a curing compound (5.3.6.4.a through 5.3.6.4.d).
3. All other slab areas may be either moist-cured or receive an application of curing compound (5.3.6.4.a through 5.3.6.4.f).
4. Whichever curing method is used, it is to commence immediately after disappearance of water sheen, and continue for at least seven days (5.3.6.1). Do not allow curing to be delayed overnight.
5. Prevent excessive moisture loss from formed surfaces (5.3.6.3). If forms are removed before seven days have elapsed, cure the formed surfaces by moist-curing or application of curing compound for the remainder of the curing period.
6. All exterior slabs are to receive an application of sealer prior to the completion of construction.
7. Interior slabs which remain exposed are to receive an application of sealer prior to the completion of construction.

3.12 FIELD QUALITY CONTROL

- A. Obtain concrete for required tests at point of placement (1.6.4.3).
- B. For each concrete Class, perform one strength test for each 50 yards or fraction thereof, for one day placements up to 300 yards. Perform one strength test for each 100 yards or fraction thereof for one day placements greater than 300 yards (1.6.4.2.d).
- C. Determine slump for each strength test (1.6.4.2.f).
- D. Determine air content for each strength test of air-entrained concrete (1.6.4.2.h).
- E. Determine concrete temperature for each strength test (1.6.4.2.g).

- F. Do not place concrete when slump, air content or temperature vary from allowable (1.6.8).
installation. Shored elevated slabs shall be tested prior to removal of shoring.
- G. Maintain records of all tests, indicating date and time of placement and exact location of the structure represented by each test. Test results will be reported in writing to Architect/Engineer, the Owner, and Contractor within 24 hours after tests. Reports of compressive strength test shall contain the project identification name and number, 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 strength, breaking load and type of break for both 7-day tests and 28-day tests.
- H. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- I. Additional Tests: The testing service will make additional test of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect/Engineer. 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.

END OF SECTION 03 30 00