

DIVISION 3 CONCRETE**SECTION 03100 CONCRETE FORMWORK****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.2 RELATED SECTIONS

- A. Section 03200 - Concrete Reinforcement.
- B. Section 03300 - Cast-in-Place Concrete.
- C. Section 03300 - Cast-In-Place Concrete: Supply of concrete accessories for placement by this section.

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 347 - Recommended Practice For Concrete Formwork.
- D. PS 1 - Construction and Industrial Plywood.

1.4 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 318.

PART 2 PRODUCTS**2.1 WOOD FORM MATERIALS**

- A. Softwood Plywood: PS 1, C Grade, Group 2.
- B. Lumber: Southern Pine species; No. 2 grade; with grade stamp clearly visible.

2.2 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gauge matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.3 FORMWORK ACCESSORIES

- A. Form Ties: Removable Snap-off type, galvanized metal adjustable length, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- F. Coordinate this section with other sections of work which require attachment of components to formwork.
- G. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03200 CONCRETE REINFORCEMENT**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

- A. Section 03100 - Concrete Formwork.
- B. Section 03300 - Cast-in-Place Concrete.
- C. Section 04300 Unit Masonry System. Reinforcement for masonry.

1.3 REFERENCES

- A. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- B. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- C. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- D. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
- E. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.4 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice.

PART 2 PRODUCTS**2.1 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished.
- C. Stirrup Steel: ASTM A82, unfinished.
- D. Welded Steel Wire Fabric: ASTM A185 Plain Type

2.2 ACCESSORIES

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
- B. Weld reinforcement in accordance with AWS D1.4.
- C. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Conform to applicable code for concrete cover over reinforcement.

END OF SECTION

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

- A. Cast-in-place concrete.
- B. Floors and slabs on grade.
- C. Control, expansion and contraction joint devices associated with concrete work including joint sealant.
- D. Equipment pads, light pole base, flagpole base, thrust blocks, manholes, and sidewalks, curbs and gutters.

1.2 RELATED SECTIONS

- A. Section 03100 - Concrete Formwork: Formwork and accessories.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03346 - Concrete Floor Finishing.

1.3 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 302 - Guide for Concrete Floor and Slab Construction.
- C. ACI 308 - Standard Practice for Curing Concrete.
- D. ACI 318 - Building Code Requirements for Reinforced Concrete.
- E. ASTM C94 - Ready-Mixed Concrete.
- F. ASTM C150 - Portland Cement.
- G. ASTM C260 - Air Entraining Admixtures for Concrete.
- H. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- I. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

1.4 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 01700 - Contract Closeout: Procedures for submittals.

- B. Accurately record actual locations of embedded utilities and components which are concealed from view.
- C. Laboratory test reports for concrete materials and mix design test.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to ACI 305R when concreting during hot weather.
- D. Conform to ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal or Type IA - Air Entraining.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Glass Fiber Reinforcement: ASTM C948 100% virgin polypropylene, fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement as manufactured by Fibermesh Company.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Fly Ash: ASTM C618 Class C.

2.3 ACCESSORIES

- A. Bonding Agent: Polymer resin emulsion Polyvinyl Acetate or Latex emulsion Two component modified epoxy resin or Non-solvent two component polysulfide epoxy.
- B. Vapor Retarder: 6 mil. fabric reinforced plastic film, type recommended for below grade application.
- C. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi 17 MPa in 48 hours and 7,000 psi 48 MPa in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler: ASTM D1751 ; Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile.

- B. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- C. Sealant: ASTM C920-79 types polyurethane compound; Dymonic manufactured by Temco.

2.5 CONCRETE MIX

- A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
- C. Provide concrete to the following mix design:

<u>Unit</u>	<u>Measurement</u>
Compressive Strength (28 day)	3000 psi
Coarse Aggregate (maximum)	73 percent by volume
Fine Aggregate (maximum)	36 percent by volume
Water/Cement Ratio (maximum)	58 by weight (mass)
Aggregate Size (maximum)	1-1/2 inch
Aggregate Size (minimum)	3/8 inch
Fly Ash Content:	Maximum 10 percent of cement content.
Slump - Plus or minus 1 inch	4 inches
Glass Fiber Reinforcement	0.1 % by volume
Air Entrained (where required)	3 percent maximum

- D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
- E. Use calcium chloride only when approved by Architect/Engineer. Do not use calcium chloride based admixtures in the base concrete slab where color hardener is called for.
- F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.
- G. Add air entraining agent to normal weight concrete mix for work exposed to exterior. Do not use air-entrained concrete in excess of 3% where color hardener is called for.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01039.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- C. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304.
- B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, embedded parts, formed expansion and contraction joints, and inserts are not disturbed during concrete placement.
- D. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends.
- E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- F. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.
- G. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- H. Extend joint filler from bottom of slab to within 1/2 inch finished slab surface.
- I. Install joint devices in accordance with manufacturer's instructions.
- J. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- K. Place concrete continuously between predetermined expansion, control, and construction joints.
- L. Do not interrupt successive placement; do not permit cold joints to occur.
- M. Place floor slabs in checkerboard or saw cut pattern indicated.
- N. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- O. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/8 inch in 12 ft.

3.4 CONCRETE FINISHING

- A. Provide formed concrete surfaces to be left exposed concrete walls smooth rubbed.
- B. Finish concrete floor surfaces in accordance with ACI 301.
- C. Wood float surfaces which will receive quarry tile ceramic tile with full bed setting system.
- D. Steel trowel surfaces which will receive carpeting resilient flooring seamless flooring thin set quarry tile and thin set ceramic tile.
- E. Steel trowel surfaces which are scheduled to be exposed.
- F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains 1:50 nominal.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure floor surfaces in accordance with ACI 308.
- D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
- E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.6 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Field inspection, and testing.
- B. Provide free access to Work and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.
- D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- E. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed.
- F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. One slump test will be taken for each set of test cylinders taken.

3.7 PATCHING

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
- C. Patch imperfections in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

SECTION 03346 CONCRETE FLOOR FINISHING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Finishing slabs-on-grade, monolithic floor slabs.
- B. Surface treatment with sealer.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete: Prepared concrete floors ready to receive finish; control and formed expansion and contraction joints and joint devices.

1.03 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 302 - Guide for Concrete Floor and Slab Construction.

1.04 MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
- B. Deliver materials in manufacturer's packaging including application instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Temporary Lighting: Minimum 200 W light source, placed 8 feet above the floor surface, for each 425 sq ft of floor being finished.
- B. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.
- C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.08 COORDINATION

- A. Coordinate work under provisions of Section 01039.
- B. Coordinate the work with concrete floor placement and concrete floor curing.

PART 2 PRODUCTS

2.01 MANUFACTURERS HARDENER AND SEALER

- | | | |
|----|--------------------|--|
| A. | W.R. Meadows, Inc. | Product - TIAH. |
| B. | Sonneborn | Product - Kure-N-Seal 0800 |
| C. | Dayton Superior | Product - Day-Chem Cure & Seal: 19% (J-21) |

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 01039.
- B. Verify that floor surfaces are acceptable to receive the work of this section.

3.02 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.
- B. Apply hardener in accordance with manufactures instructions and steel trowel surfaces which are scheduled to be exposed.
- C. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains 1/4 inch per foot.

3.03 FLOOR SURFACE TREATMENT

- A. Apply sealer in accordance with manufacturer's instructions as scheduled on floor surfaces.

END OF SECTION