

## SECTION 03100

# CONCRETE FORMWORK

### PART 1 – GENERAL

#### 1.01 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. ASME A17.1 – Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks.
- E. PS 1 – Construction and Industrial Plywood.

#### 1.02 DESIGN REQUIREMENTS

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

#### 1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347.
- B. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Washington.

#### 1.04 REGULATORY REQUIREMENTS

- A. Conform to Uniform Building Code and Local Building Department requirements for design, fabrication, erection, and removal of formwork.

#### 1.05 DELIVERY, STORAGE AND PROTECTION

- A. Section 01600 – Product Requirements: Transport, handle, store, and protect products.

- B. Deliver void forms and installation instructions in manufacturer's packaging.
- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

#### **1.06 ALTERNATES**

- A. See Section 01230 for bidding alternates affecting the Work of this Section.

#### **1.07 SUSTAINABLE BUILDING REQUIREMENTS**

- A. See Section 01011 for sustainable building requirements affecting the work of this Section.

### **PART 2 – PRODUCTS**

#### **2.01 WOOD FORM MATERIALS**

- A. Conform to ACI 347,
- B. Form Panels: For concrete exposed to view use HDO plywood with high-density phenolic overlay, Simpson Timber Company "Multipour HDO". Form panels for all other concrete shall be B-B Grade form plywood.

#### **2.02 FORMWORK ACCESSORIES**

- A. Form Ties: Provide snap-off metal form ties, designed to prevent form deflection, and to prevent spilling concrete surfaces upon removal. The portion of tie remaining within concrete after removal of exterior parts shall be recessed  $\frac{3}{4}$  inch from the outer concrete surface and will not leave a hole larger than 1 inch diameter in the concrete surface. Form ties shall be manufactured items with stress value published.
- B. Form Release Agent: Colorless mineral oil that will not stain concrete or absorb moisture.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

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

### 3.02 EARTH FORMS

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

### 3.03 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 overstressing 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 that are not indicated on drawings.
- F. Provide  $\frac{3}{4}$  inch chamfer at all external corners.
- G. Coordinate this Section with other sections of work that require attachment of components to formwork.
- H. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

### 3.04 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 that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

### **3.05 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 that 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.

### **3.06 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.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

### **3.07 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerance required by ACI 301.
- B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

### **3.08 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.

### **3.09 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 a 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

#### 1.01 REFERENCES

- A. ACI 301 – Structural Concrete for Buildings.
- B. ACI 318 – Building Code Requirements for Reinforced Concrete.
- C. ACI SP-66 – American Concrete Institute – Detailing Manual.
- D. ASTM A82 – Cold Drawn Steel Wire for Concrete Reinforcement.
- E. ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.
- F. AWS D1.4 – Structural Welding Code for Reinforcing Steel.
- G. AWS D12.1 – Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- H. CRSI – Concrete Reinforcing Steel Institute – Manual of Practice.
- I. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.
- J. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.
- K. IBL – International Building Code.
- L. Structural General Notes on Structural Drawings.

#### 1.02 SUBMITTALS

- A. Section 01330 – Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, supporting and spacing devices and other arrangements and assemblies as required for fabrication and placement of reinforcement for all cast-in-place concrete work.

### 1.03 **QUALITY ASSURANCE**

- A. Codes and Standards: Comply with provisions of references listed in Paragraph 1.01 (above), except where more stringent requirements are shown or specified. Refer also to Structural General Notes on Structural Drawings.

### 1.04 **REGULATORY REQUIREMENTS**

- A. Conform to Uniform Building and Local Building Department requirements for testing inspection, etc. during construction.

### 1.05 **ALTERNATES**

- A. See Section 01230 for bidding alternates affecting the work of this Section.

### 1.06 **SUSTAINABLE BUILDING REQUIREMENTS**

- A. See Section 01011 for sustainable building requirements affecting the work of this Section.

## PART 2 – PRODUCTS

### 2.01 **REINFORCEMENT**

- A. Reinforcing Steel: Refer to Structural General Notes on Structural Drawings.

### 2.02 **ACCESSORIES**

- A. 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.
- B. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size, and shape as required.

### 2.03 **FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
- B. Fabrication: Conform to CRSI. Provide all bars in longest lengths available or required; conform to sizes, shapes, and dimensions shown on Structural Drawings.

## PART 3 – EXECUTION

### 3.01 PLACEMENT

- A. Place in accordance with CRSI. 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. Unless shown otherwise, maintain minimum  $\frac{3}{4}$  inch space between all formwork and reinforcement, tie wires, etc.

END OF SECTION



## SECTION 03300

# CAST-IN-PLACE CONCRETE

### PART 1 – GENERAL

#### 1.01 REFERENCES

- A. ACI 301 – Structural Concrete for Buildings.
- B. ACI 302 – Guide for Concrete Floor and Slab Construction.
- C. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
- D. ACI 305R – Hot Weather Concreting.
- E. ACI 306R – Cold Weather Concreting.
- F. ACI 308 - Standard Practice for Curing Concrete.
- G. ACI 318 – Building Code Requirements for Reinforced Concrete.
- H. UBC – Uniform Building Code.
- I. Structural General Notes on Drawings.

#### 1.02 REGULATORY REQUIREMENTS

- A. Conform to Uniform Building Code and Local Building Department requirements for testing, inspection, etc. during construction.

#### 1.03 TESTS

- A. Testing and analysis of concrete will be performed under provisions of Section 01400.
- B. Provide copy of concrete mix design submittal for each class of concrete to Testing Lab ten (10) days prior to commencement of work.

#### 1.04 **SUBGRADE APPROVAL**

- A. Subgrade Approval: Do not proceed with on-grade concrete placement over any subgrade condition until the Soils Engineer and testing lab have approved existing subgrade, structural backfill, and utility trench backfill.
- B. Coordination: Contractor shall contact and schedule review of subgrade with Soils Engineer and testing laboratory ten (10) days (minimum) prior to any on-grade concrete placement.

#### 1.05 **SUBMITTALS FOR REVIEW**

- A. Section 01330 – Submittals: Procedures for submittals.
- B. Product Data: Provide data on joint devices, attachment accessories, admixtures.

#### 1.06 **QUALITY ASSURANCE**

- A. Quality Control: Conform to requirements of Section 01400.
- B. Codes and Standards: Comply with provisions of references listed in Paragraph 1.01 (above), except where more stringent requirements are shown or specified. Refer also to Structural General Notes on Structural Drawings.
- C. Concrete and Formwork: Performed by company experienced for five (5) years (minimum) in construction of top quality, site cast concrete work, familiar with and capable of producing concrete work in accordance with referenced standards listed in Paragraph 1.01 (above) and these specifications and drawings.

#### 1.07 **ALTERNATES**

- A. See Section 01230 for bidding alternates affecting the work of this Section.

#### 1.08 **COLORS**

- A. Colors are specified in Colors/Materials Schedule on drawings.

#### 1.09 **SUSTAINABLE BUILDING REQUIREMENTS**

- A. See Section 01011 for sustainable building requirements affecting the work of this Section.

## PART 2 – PRODUCTS

### 2.01 CONCRETE MATERIALS AND MIX

- A. Concrete: Refer to Structural General Notes on Structural Drawings.

### 2.02 ADMIXTURES

- A. Admixtures: Only upon Structural Engineer's approval.
- B. Air Entertainment Admixture: ASTM C260 at all exterior concrete.

### 2.03 ACCESSORIES

- A. Bonding Agent: 100% acrylic emulsion; manufactured by the Burke Company or approved. Use for all plug or patch work on cured concrete to increase bond strength.
- B. Non-Shrink Grout (Non-Structural): Premixed compound consisting of non-metallic aggregate, cement, water reducing, and plasticizing agents, capable of 4500 PSI at seven (7) days.
- C. Non-Shrink Grout (Structural): See Structural General Notes on Structural Drawings.

### 2.04 JOINT DEVICES AND FILLER MATERIALS

- A. Joints: Refer to Structural General Notes and Details on Structural Drawings.
- B. Joint Filler: ASTM D994; asphalt impregnated fiberboard or felt, ¼ inch thick; full depth of slab.

### 2.05 VAPOR BARRIERS

- A. Manufacturer: Stego Industries LLC.
- B. Vapor Barrier: Stego Wrap, 15-mil thick under-slab polyolefin vapor barrier. Comply with ASTM E1745 class A, ASTM D882, ASTM D1709 and ASTM D96 standards.
- C. Tape: 4 inch wide Stego red polyethylene duct tape, used at all seams and penetrations. Stego Cold Weather tape used in low temperatures.
- D. Mastic: Stego Mastic used as an alternate for pipe penetrations.

- E. Installation: According to manufacturer's instructions and ASTM E1643.

## 2.06 CURING MATERIALS

- A. Water: Clean and drinkable.
- B. Curing Membrane: White 4 mil polyethylene film or a combination sheet plastic and paper, 20 ft. minimum roll width.
- C. Concrete Curing Compound: A transparent curing, sealing, and dust proofing compound for interior and exterior concrete.
  - 1. No oils, saponifiable resins waxes or chlorinated rubbers.
  - 2. Coordinate work with 07900 – Joint Sealers.
  - 3. Apply to concrete as recommended by manufacturer's product data. Verify compatibility with flooring adhesives where floor covering is scheduled.
- D. Absorptive Mat: Burlap-polyethylene minimum 8 oz./sq. yd., bonded to prevent separation during use.

## 2.07 CONCRETE FLOOR SEALER

- A. Nox-Crete Products Group, "Duro-Nox" hardener, sealer, densifier and dustproofers.

## 2.08 CEMENTIOUS UNDERLAYMENT

- A. Cementitious-based powder with non-re-emulsifiable architectural grade, acrylic latex, liquid bonding agent suitable for interior and exterior use on cured concrete. Product must be capable of smooth, thin edge tapers.
  - 1. Raeco Products – Raecolith R-25.
  - 2. Substitutions: Under provisions of Section 01600.

## 2.09 SUSTAINABLE BUILDING REQUIREMENTS

- A. See Section 01011 for sustainable building requirements affecting the Work of this Section.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 01310.
- 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.

### 3.02 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 dowelled 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.
- D. Responsibility: Contractor is responsible for correcting at his own expense, any moisture related floor-coating failures due to improper installation and protection of vapor barrier.

### 3.03 NOTIFICATION PRIOR TO PLACING CONCRETE

- A. Notify Architect/Engineer minimum twenty-four (24) hours prior to commencement of concreting operations.
- B. Notify Owner's testing lab prior to concrete placement and coordinate their field inspections.
- C. Notify Building Department in accordance with their requirements prior to concrete placement.

### 3.04 PLACING CONCRETE

- A. Place concrete in conformance with ACI 304. Conform to ACI 305R for hot weather concreting and ACI 306R for cold weather concreting.

- B. Notify Architect/Engineer minimum twenty-four (24) hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.
- D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends.
- E. Repair vapor barrier 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 thick joint filler.
- G. Place joint filler in 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 1/8 inch of finished slab surface.
- I. Install joint devices in accordance with manufacturer's instructions.
- J. Install construction joint devices in coordination with pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- K. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- L. Install joint covers in longest practical length, when adjacent construction activity is complete.
- M. Place concrete continuously between predetermined expansion, control, and construction joints.
- N. Do not interrupt successive placement; do not permit cold joints to occur.
- O. Place floor slabs in pattern indicated.
- P. Saw cut joints within twenty-four (24) hours after placing. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.

### 3.05 CONCRETE FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301.
- B. Wood float surfaces that will receive tile flooring with full bed setting system.
- C. Steel trowel surfaces that will receive carpeting, resilient flooring, seamless flooring or thin set quarry tile.
- D. Steel trowel surfaces that are scheduled to be exposed.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains.

### 3.06 CURING AND PROTECTION

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

### 3.07 CONCRETE FLOOR SEALER

- A. Prior to installation of sealer, check and repair any defects in the slab surface. Grind high spots and cut out and re-pour low spots.
- B. Install specified sealer in strict compliance with manufacturer's specifications. Contractor to dispose of all waste materials resulting from sealer application in accordance with applicable regulations.

### 3.08 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.

**3.09 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 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.

**3.10 PROTECTION**

- A. Protect all concrete from mechanical damage or contamination by any substance which would adversely affect the strength, integrity, appearance, usefulness or successful performance of coatings, finishes, or floor coverings applied to the concrete.
- B. Contractor is solely responsible for the means and methods employed to afford this protection.

END OF SECTION