

SECTION 03100

CONCRETE WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

- A. The extent of concrete work required is shown on drawings and includes but is not limited to:

Formwork
Reinforcing
Placing Concrete
Finishing

2. Examine the Drawings, and the Structural General Notes in particular, for details which describe the extent of structural steel work.
1. Understand that the AGeneral Notes@ listed on the Structural Drawings, which specify the performance requirements generally found in this Section, are left on the Drawings for the convenience of the Contractor to facilitate fabrication and assembly.
 2. Interpret the contents of this section and the Structural General Notes as complementary in nature and, in the spirit of the General Conditions, shall be read collectively to the work.

1.02 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to work of this section.

1.03 REFERENCES

ACI 301 - Structural Concrete for Buildings.

ACI 318 - Building Code Requirements For Reinforced Concrete.

ACI SP-66 - American Concrete Institute - Detailing Manual.

ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.

ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

1.04 QUALITY ASSURANCE:

- A. Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings."

ACI 318 "Building Code Regulations for Reinforced Concrete."

Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

ACI SP-15.

Maintain one copy of each document on site.

- B. Concrete Testing Service: Employ, at Contractor's expense a testing laboratory acceptable to Architect to perform material evaluation tests and to design concrete mixes.

1. Following tests will be required:

Sampling: Per ASTM C 172.

Slump: Per ASTM C 143, one (1) test for each load at point of discharge.

- C. Air Content: Per ASTM C 173, one (1) test for each set of compressive strength specimens.
- D. Compressive Strength: Per ASTM C 39, one set for each 10 cu. yds. or fraction thereof of each class of concrete; test two (2) specimens at 7 days, test three (3) specimens at 28 days retain on (1) for later testing if required.
- E. If the total quantity of a given class of concrete is less than 50 cu. yds., strength tests may be waived at the Architect's discretion.
- F. Test results will be reported in writing to the Architect, Contractor, and concrete producer on the same day tests are made.
- G. Defective concrete may require additional tests. Additional tests will be at the Contractor's expense.

1.04 SUBMITTALS:

Submit under provisions of Section 01300.

PRODUCT DATA

Submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

SHOP DRAWINGS

- A. Meet requirements of applicable portions of "Details and Detailing of Concrete Reinforcement" by ACI 315, latest edition, and of Division 1 hereof.
- B. Show bending, assembly, splicing, sizes, bar lengths, and marking of bars. Indicate bar spacing by dimension.
- C. Show wall, column, and beam reinforcing with necessary details in elevation. Show slab reinforcing, with necessary details, in plan. Locate sleeves, holes, accessories, and anchors by dimensions.
- D. Furnish prints of approved shop drawings to trades that have items to be embedded in, or connected to concrete work.
- E. Reproduction of the Contract Drawings for use in producing shop drawings is prohibited.

SAMPLES

Submit samples of materials as requested by Architect/Engineer, including names, sources, and descriptions.

LABORATORY TEST REPORTS

Submit laboratory test reports for concrete materials and mix design test.

MATERIALS CERTIFICATES

Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements. Provide certificates from admixture manufacturers that chloride content complies with specification requirements.

1.05 PROJECT CONDITIONS:

PROTECTING

- A. Comply with applicable requirements of "Cold Weather Concreting", ACI 306, and "Hot Weather Concreting", ACI 305
- B. Do not place concrete if temperature is below 40 degrees F. except with specific approval, and then be prepared to provide heat to maintain concrete temperature as recommended in ACI 306.
- C. Reduce concrete temperatures to prevent rapid evaporation of water in hot weather.
- D. Protect persons from injury and property from damage. Satisfactorily repair or remove and replace work that has been damaged.

1.06 DELIVERING AND STORING:

- A. Deliver unopened, packaged materials to site in manufacturer's original labeled containers. Schedule deliveries to avoid delays and to prevent greater accumulations that can be suitably store at Site.
- B. Arrange deliveries to provide sufficient quantities to permit continuity of placing for any phase of work. Do not change suppliers or brands for any phase of work, without specific approval.
- C. Store materials to prevent damage to other materials or to structure. Store cementitious material in dry, weathertight, ventilated spaces. Store aggregates to exclude foreign matter and to maintain gradation. Do not store reinforcing in contact with the ground.
- D. Laboratory Tests: Submit laboratory test reports for concrete materials and mix design test as specified.
- E. Materials certificates may be provided in lieu of materials laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
- F. Samples: Submit samples of materials as specified and as otherwise required by Architect, including names, sources and descriptions.

PART 2 PRODUCTS AND MATERIALS

2.01 FORM MATERIALS:

- A. Forms for Exposed Concrete: Provide plywood, metal framed plywood or other acceptable panel-type materials.
 - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Concrete: Provide plywood, lumber, metal or other acceptable material. Provide lumber dressed or at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- D. Expansion Joints: Premolded filler strips conforming to ASTM D-1751 and FS HH-F-34E Type I. Provide Homex 300, natural gray color, as manufactured by Homasote Company or equivalent.
- E. Exposed Expansion Joints: Non-extruding expansion joint filler equal to Tex-Cork/Cork Board expansion joint filler as manufactured by J & P Petroleum Products or equivalent and meeting FS HH-F-341F Type II, Class B.
- F. Expansion Joints: Premolded filler strips conforming to ASTM D-994/71 and FS HH-F-341F

Type III. Provide Tex-Mastic Asphalt expansion joint filler, as manufactured by J. & P. Petroleum, Inc. or equivalent.

2.02 REINFORCING MATERIALS:

Fabricate concrete reinforcing in accordance with ACI SP-66.

- A. Reinforcing Bars: ASTM A 615, Grade 60 deformed.
- B. Steel Wire: ASTM A 82, plain, cold-drawn, steel.
- C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- D. Supports for reinforcement: Provide bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.
 - 1. For slabs-on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports may be exposed provide supports with legs which are plastic protect, stainless steel protected. (CRSI, Class Z.)
- 5. Tie Wire: Minimum 16 gage annealed type.
- 6. Field inspections will be performed under provisions of Section 01400.

2.03 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type I. Use one brand of cement throughout project.
- B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
- C. Water: Potable.
- D. Air-Entraining Admixture: ASTM C 260, use in all concrete.
- E. Water-Reducing Admixture: ANSI/ASTM C 494, Type A and contain not more than 1% chloride ions.
 - 1. Available Products: Subject to compliance with requirements, products, which may be incorporated in the work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - "Pozzolith 322N"; Master Builders
 - "Plastocrete 161"; Sika Chemical Corporation
 - "Chemtard"; Chem-Masters Corporation
- F. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F of the sulfonated melamine formaldehyde condensate based materials type and contain not more

than 1% chloride ions.

- G. Water-Reducing, Retarding Admixture: ASTM C 494, Type D and contain not more than 1% chloride ions.
- H. Calcium Chloride not permitted.
- I. Fly Ash up to 15% by weight of cement shall be allowed. Type C or F, ASTM C 618.

2.04 RELATED MATERIALS:

- A. Moisture Vapor Barrier: Provide moisture barrier under all interior concrete slab on grade. Use only materials which are resistant to decay when tested in accordance with ASTM E 154.
 - 1. Provide Stego Wrap, single ply Polyethylene sheet not less than 10 mils thick, as manufactured by Stego Industries, Inc. Overlap all seams a minimum of 6 inches and tape with Stego Tape. Follow manufacturer's written installation instructions.
- B. Sealer & Hardner - Aqueous acrylic non-yellowing coating, 30% solids, compliance with TT-C800A, 5 yr. warranty against DUSTING. Minimum coverage 300 sq. ft. per gal. Products L & M Dress & Seal, Kure-N-Seal 30 by Sonneborn and Thoroglaze H by Thoro System Products.
- C. Non-Corrosive, Non-Stain, Non-Shrink precision grout compliance with CRD-C-621. Acceptable products Crystex/Duragrout by L&M, Master-Flow 713 by Master Builders, 5 Star by U.S. Grout.
- D. Abrasive non-skid topping - AO Grip-It by L&M, Frictex NS by Sonneborn.
- E. Bonding Compound - Non-reversible acrylic. Everbond by L&M, Acryl Set by Master Builders, Sika Latex by Sika.
- F. Epoxy Joint Filler - T-250LCS by Permagile, Epoflex by L&M. Two part, 100% solids flexibilized compound meeting ASTM D2240 shore hardness 80 + 10.
- G. Epoxy Bonding Adhesive - Bond-1 by Permagile, Sika-Dur 32 Hi-Mod by Sika, Epobond by L&M. Adhesive shall be used to eliminate cold joints, 2 part, 100% solids for use on DAMP or DRY surfaces.
- H. Form Release Agent - Shall be non-transferring, non-staining, and 100% chemically active. "DeBond" by L&M, "Magic Coat" by Nox-Crete, and "Pro-Cote" by Protex.
- I. Patching & Repair Mortar - One component, fiber-reinforced, rapid setting and non-shrinking. Shall be non-corrosive and resist sulfate attack. Durapatch Industrial by L&M, Set 45 by Master Builders, and Patch by Sonneborn.
- J. High Hydrostatic Heads Capillary Waterproofing - For NEGATIVE SIDE "hot patch" active leaks, foundation leaks, etc. Product shall be EPA approved for potable water, non-toxic rated by HSLA standards. Permaquik by Permaquik, Inc. and Vandex by Vandex Corp.

- K. Curing:
1. Moisture-Retaining Cover: Waterproof paper or a polyethylene film complying with ANSI/ASTM C 171.
 2. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming compound complying with ANSI/ASTM C 309, Type I, Class A with minimum 30% solids content unless other type acceptable to Architect.
 - a. Products: Subject to compliance with requirements, provide one of the following:
"Masterkure"; Master Builders
"Kure-N-Seal"; Sonneborn-Contech
"L&M Cure R" Construction Chemicals

2.05 PROPORTIONING AND DESIGN OF MIXES:

- A. Mix design for each strength of concrete required shall be prepared by an independent testing laboratory and submitted to the Architect for his approval. No concrete shall be poured until Architects approval has been received.
- B. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
 1. 4000 psi 28-day compressive strength; 580 lbs. cement per cu. yd. minimum; W/C ratio, 0.44 maximum non-air entrained, 0.35 maximum air entrained.
- C. Adjustment to Concrete Mixes: Mix design adjustment may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to owner and as accept by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.
- D. Admixtures:
 1. Use air-entraining admixture in all concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 2% to 4%.
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 1. Ramps and Sloping Surfaces: Not more than 3".
 2. Reinforced Foundation Systems: Not less than 1" and not more than 3".
 3. Concrete containing HRWR admixture (super plasticizer): Not more than 8".
 4. Other Concrete: Not less than 1" and not more than 4".

2.06 CONCRETE MIXING:

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
 1. Do not add additional water to the batch without the approval of the Architect.
- B. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

1. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C) reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F. (30 degrees C) reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMS:

- A. Design, erect, support, brace and maintain formwork to support all vertical and lateral loads that might be applied until such loads can be supported by concrete structures.
- B. Construct forms complying with ACI 347, 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, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- C. 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 tab forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyless, reglets recesses to prevent swelling and for easy removal.
- D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete. Locate temporary openings at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
 1. Provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete and which will not leave holes larger than 1" diameter in concrete surfaces.
- G. Provisions for other trades: Provide openings in concrete formwork to accommodate work of other trades. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

3.02 PLACING REINFORCEMENT

- 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 which 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 required.
 - D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
7. Do not displace or damage vapor barrier. Conform to ACI 318 for concrete cover over reinforcement.

3.03 JOINTS:

- A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Place joints perpendicular to the main reinforcement. Continue reinforcing across construction joints unless noted on drawings to contrary.
- B. Provide Keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings.
- C. Construct Isolation Joints in slabs on ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.
- D. Construct control joints in slabs on-ground to form panels of patterns as shown. Use inserts 1/4" wide x 1/5 to 1/4 of the slab depth.
- E. Joint filler and sealant materials are specified in Division 7 of these specifications.
- F. Form contraction joints by inserting premolded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.
 - 1. Contraction joints may be formed by saw cuts as soon as after slab finishing without dislodging aggregate.
 - 2. Joint sealant material is specified in Division 7 sections of these specifications.

- G. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

3.04 INSTALLATION OF EMBEDDED ITEMS:

- A. Set and build into forms anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips and Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.05 PREPARATION OF FORM SURFACES:

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement in places.
 - 1. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions.
 - 2. Do not allow excess form-coating materials to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT:

- A. Pre-replacement Inspection, inspect formwork installation, and reinforcing steel for completeness. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten woods forms immediately before placing concrete where form coatings are not used.
- B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- C. General: Comply with ACI 304 and as herein specified.
- D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- E. Placing Concrete in Forms in horizontal layers not deeper than 24" 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.
- F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

