PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place concrete.
2. Concrete accessories.
3. Formwork, shoring, bracing, and anchorage.
4. Concrete reinforcement.
5. Underslab vapor retarder.
6. Concrete Sealer.

B. Related Sections:
1. 003152 - Testing and Inspection Services: Owner paid testing and inspections.
2. 079200 - Joint Sealants: Expansion joint fillers.
3. 312000 - Earth Moving: Fill under slabs on grade.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Concrete Institute (ACI):
1. 117 - Standard Specification for Tolerances for Concrete Construction and Materials.
2. 301-05 - Specifications for Structural Concrete.
3. 315 - Details and Detailing of Concrete Reinforcement.

B. American Society for Testing and Materials (ASTM):
1. A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
2. C33 - Specifications for Concrete Aggregates.
3. C94 - Specifications for Ready Mixed Concrete.
4. C132 - Test for Slump of Portland Cement Concrete.
5. C150 - Specification for Portland Cement.
6. C156 - Test Method for Water Retention by Concrete Curing Materials.
7. C171 - Specification for Sheet Materials for Curing Concrete.
8. C260 - Specifications for Air-Entraining Admixtures for Concrete.
9. C309 - Specification for Liquid Membrane Forming Compounds for Curing Compounds.
10. C494 - Specifications for Chemical Admixtures for Concrete.
11. C618 - Specification for Fly Ash and Raw or Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
12. C939 - Test Method for Flow of Grout for Preplaced-Aggregate Concrete
13. C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
14. C1315 - Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
15. D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
16. E1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit data for each accessory, admixture, and curing material proposed for the work.

C. Shop Drawings:
   1. Reinforcing:
      a. Detail reinforcing in accordance with ACI 315. Indicate reinforcement sizes, spacings, locations and quantities of reinforcing, bending and cutting schedules, splicing, and supporting and spacing devices.
      b. Indicate embedded items.
   2. Slab Layouts: Dimension locations of control, expansion, and construction joints. Relate to building grid lines.

D. Quality Control Submittals:
   1. Mix Designs: Prior to concrete work, submit mix designs for approval.
   2. Test Results: Submit test results per ASTM C311 performed less than 6 months prior to use for approval by Architect.
   3. Certifications: Submit mill certificates for cement, aggregates, and reinforcing.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Concrete work is subject to special testing and inspection as specified in 014500. Notify Architect at least 48 hours before concrete is poured.

C. Pre-Installation Conference:
   1. At least 35 days prior to start of concrete work the Contractor shall hold, in accordance with Section 013119, a meeting to review the detailed requirements of the concrete design mixes and to determine the procedures for producing proper concrete construction.
   2. Required in attendance:
      a. Contractor's superintendent.
      b. Testing Laboratory representative.
      c. Concrete subcontractor.
      d. Ready-mix producer.
      e. Admixtures manufacturer's representative.
      f. Architect/Engineer
      g. All subcontractors with work to be installed in, or affected by concrete work.
   3. Notify Architect 10 days prior to the scheduled date of the meeting.
   4. Agenda: Include the following.
      a. Installation scheduling and coordination; scheduling of mock-up construction and review.
      b. Classes of concrete required; mix designs; applicable references.
      c. Formwork.
      d. Reinforcement and placement.
      e. Climatic conditions; hot and/or cold weather concreting procedures (as appropriate); unusual placing conditions.
      f. Substrate preparation; placement methods; construction joints.
      g. Flatwork; flatness and levelness requirements; finishing; criteria for acceptance; remedies.
      h. Curing and protection procedures
      i. Site quality control; inspection and testing requirements.
      j. Sealers; locations and coverage rates

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Unless specified otherwise, conform to ACI 301.

B. Plywood:
   1. APA rated High Density Overlay or Medium Density Overlay, Plyform Class 1. EXT.

C. Form Ties: Snap-off metal; metal washer ends.

2.2 REINFORCING

A. Reinforcing Steel: Types as indicated on the structural drawings.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, normal - Type 1 Portland, grey color.

B. Fly Ash: ASTM C618, Class C or F; loss on ignition (LOI) not to exceed 1 percent. Use fly ash from one single source for the whole Project.

C. Normal Weight Fine and Coarse Aggregates: ASTM C33; severe weather exposure.

D. Water: ASTM C94, para. 5.1.3

2.4 ADMIXTURES

A. Air-Entrainment: ASTM C 260; Master Builders Inc. "Micro-Air" or "MBVR", Euclid Chemical Co. "Air Mix," or approved.

B. Water Reducer Normal: ASTM C 494, Type A; Master Builders Inc. "Pozzolith/Polyheed," Euclid Chemical Co. "Eucon WR 75," or approved.

C. High Range Water Reducer (Superplasticizer): ASTM C 494, Type F or G and shall be of the second or third generation type. Shall be batch plant added, extend plasticity time, reduce water 20 to 30 percent. Master Builders Inc. "Rheobuild," Euclid Chemical "Eucon 37," or approved.

D. Accelerator: ASTM C 494, Type C or E, non-corrosive, non-chloride; Master Builders "Pozzutech 20," Euclid Chemical Co. "Accelgard 90," or approved.

E. Set Retarder: ASTM C494, Type B.

2.5 ACCESSORIES

A. Bonding Agent: Acrylic type; Sonneborn "Sonnocrete", W.R. Grace "Duraweld C", Euclid Chemical Co. "Flex-con", or approved.

B. Non-Shrink Grouts: ASTM C1107, Grade B; non-shrink non-catalyzed natural aggregate grout; minimum compressive strength of 7000 PSI at 28 days; 25 to 30 second flow when tested in accordance with ASTM C939 at 45 to 90 degrees F; cement gray in color; Master Builders Inc. "Masterflow 928," Euclid Chemical Co. "HiFlow Grout," or approved.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces when applied to forms or form liners.

D. Curing Materials:
   1. Waterproof Sheet Material: Waterproof paper in accordance with ASTM C171; reinforced waterproof kraft paper; white color at exterior applications; Burke Kraft Curing Paper Type I-SK-30, or approved.
   2. Mats and Burlap: Fabric covering composed of quilted polyethylene sheeting laminated to outer covering of burlap, cotton, or other approved fabric; outer covering shall weigh not less than 6 ounces per square yard.
   3. Curing Compound: ASTM C309; clear or translucent with fugitive dye; moisture loss not more than 0.055 gr./sq.cm. when tested in accordance with ASTM C156 and applied in a single coat at the manufacturers recommended rate. Euclid Chemical Co. "SuperFloor Coat" or "Floorcoat," or approved.
   4. Curing/Sealing Compound: ASTM C309; water based curing compound; Euclid Chemical Company "Aqua-Cure," Sonneborn "Kur-N-Seal WB," Burke by Edoco "Spartan-Cote WB II," or approved.

E. Underslab Vapor Retarder: ASTM E1745, Class A; one of the following:

1. "Stego Wrap 15 Mil Vapor Barrier" by Stego Industries, LLC (877-464-7834).
2. "Vapor Block 15" by Raven Industries (800-635-3456).
3. "Griffolyn 15 Mil Green" by Reef Industries, Inc. (800-231-6074).
4. “Perminator 15 Mil” by WR Meadows, Inc. (847-214-2100)
5. “Florprufe 120” by WR Grace (866-333-3726).

F. Prefabricated Slab Construction Joints: Burke by Edoco "Keyed Kold Joint," with splice plates, stakes, and driving accessories, or approved; depth 1/2 inch less than slab thickness, galvanized sheet metal tongue and groove joint form, with knockouts for passing reinforcing bars through.

G. Preformed Joint Fillers:
1. Non-extruding type; ASTM D1751; Sonneborn "Expansion Joint Filler,” WR Meadows “Sealtight Fiber”, " Burke by Edoco "Fiber expansion Joint,” or approved.
2. Joint Cap: Strippable plastic type; W.R. Meadows "SealTight Snap-Cap", Burke by Edoco "Joint Cap", or approved; width to match expansion joint filler material.

H. Finishing Aid: Evaporation retardant for preventing rapid drying during hot windy weather, Master Builders "Confilm."

2.6 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94, and in accordance with the requirements indicated on the structural drawings.

B. Concrete at slabs on grade shall have a maximum water/cement ration of 0.45.

C. Admixtures:
1. All concrete shall contain the specified water reducing or high range water reducing admixture, except concrete with a required water/cement ratio of 0.45 or lower shall contain a high range water reducing admixture.
2. All concrete required to be air entrained shall contain air entraining admixture to produce 4% to 6% air.
3. All concrete placed in ambient temperatures from 40 degrees F to 20 degrees F, and all slab concrete placed in ambient temperatures below 50 degrees F, shall contain an accelerator at the manufacturer's required dosage.
4. All concrete placed in ambient temperatures of 90 degrees F or above, shall contain a set retarder at the manufacturer's required dosage.

D. Provide 28 day compressive strengths as indicated on the Structural Drawings. Where not indicated on the Structural Drawings, provide minimum 3000 psi compressive strength unless indicated otherwise.

E. Maximum amount of fly ash is indicated on the Structural Drawings.

2.7 REINFORCEMENT FABRICATION

A. Fabricate as indicated and in accordance with ACI 315.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 FORMWORK ERECTION

A. Verify lines, levels, and measurement before proceeding with formwork. Align form joints.

B. Use plywood forms, unless other systems are approved by the Architect.

C. Use form coating on forms in accordance with the manufacturer's recommendations. Verify that form coatings will not affect the bond of subsequent concrete surface treatments.

D. Coordinate with work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

E. Tolerances: Comply with ACI 117.

F. Where earth forms are used, hand trim sides and bottoms of earth forms. Remove loose dirt.

3.3 REINFORCEMENT

A. Place, support, and secure reinforcement against displacement.

B. Locate reinforcing splices not indicated on the drawings at points of minimum stress.

C. Provide laps and concrete cover as indicated in the Drawings.

3.4 UNDERSLAB VAPOR RETARDER

A. Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions under all interior slabs-on-grade.

B. Lap and seal all seams a minimum of 6 inches, seal around all penetrations, lap and seal against foundation walls and footings with manufacturer’s recommended sealing tape or mastic.

3.5 PLACING CONCRETE

A. In accordance with ACI 301.

B. Bonding Agent: Mix thoroughly and apply strictly in accord with the manufacturer's instructions; do not use when ambient temperature is below 45 degrees F. Place concrete in contact immediately while bonding agent is still tacky.

3.6 SUBSEQUENT TREATMENT FOR FORMED SURFACES

A. Provide smooth form finish for concrete to remain exposed in the finished work; rough form finish for concrete to remain concealed in the finished work.

3.7 SLABS

A. Expansion Joints for Slabs on Grade:
   1. Place expansion joints at locations indicated and where exterior slabs abut concrete walls, the building perimeter, and other fixed objects abutting or within the slab area. At exterior sidewalks, place expansion joints at maximum 20 foot intervals unless otherwise indicated.
   2. Form joints 1/2 inch wide x full depth of slab.
   3. Form expansion joints with preformed joint filler. Install strippable joint at joints to receive sealant specified in Section 079200.
   4. Tool expansion joints to 1/4 inch radius.
   5. Discontinue reinforcing at the expansion joint.
   6. Place perpendicular to longitudinal axis of wall and curbs. Where possible, make joints of curbs coincide with joints in walks.

B. Control Joints for Slabs on Grade:
   1. Make joints straight; perpendicular or parallel to building lines and slab edges, as appropriate.
   2. Control joints shall be saw cut or tooled, unless indicated otherwise.
   3. Radius tooled control joints to match expansion joints.
   4. Control joints shall penetrate the slab a minimum of 1/4 the thickness of the slab and shall be 3/16 inch in width minimum; 1/4 inch width in sidewalks.
   5. Space control joints at the locations indicated, except when not indicated locate in at 32 times the slab thickness. At exterior sidewalks, place control joints at maximum 5 foot intervals .
   6. Align joints with column lines when ever possible. Joints shall form rectangular panels with the long side less than 1-1/2 times the length of the short side. Provide circular or diamond shaped

joint lines around columns. Locate control joints at reentrant corners. Coordinate with placement of joints in tile surfaces.

C. Construction Joints: Place at either expansion or control joint locations for slab on grade construction.

D. Curing:
   1. Moisture cure all concrete for a minimum of 7 days, unless approved or specified otherwise.
   2. Use curing/sealing compound on concrete slabs scheduled to receive sealer.
   3. A curing compound may be used on all exterior slabs, sidewalks, and curbs.
   4. Use waterproof sheet material, mats or burlap at surfaces to receive subsequent bonded finish materials, including concrete stain and sealing compound. A curing compound may be used on surfaces to receive subsequent bonded finish materials, provided the curing compound is approved in writing by the manufacturer of the adhesive or the bonding finish material. Curing compound may also be used on surfaces to receive subsequent bonded finish materials, provided the curing compound is removed with shot blasting or other approved method prior to installation of bonded materials.
   5. Apply curing compounds and curing/sealing compounds in accordance with the manufacturer's recommendations.
   6. Maintain concrete temperatures above 50 degrees F.

E. Finishes:
   1. Full Trowel finish interior floor slab surfaces, unless specified otherwise.
   2. Light steel trowel finish interior floor slab surfaces scheduled to receive tile, carpet, or other similar bonded materials.
   3. Broom finish exterior slabs, sidewalks, and curbs.

F. Curing/Sealing Compound: Apply a second coat of curing/sealing compound to concrete slabs scheduled to receive sealer. Clean floor and apply just prior to substantial completion. Apply in accordance with the manufacturer's recommendations.

G. Tolerance: Provide Random Traffic floor tolerances as follows, when measured in accordance with ASTM E1155, including those floors to receive subsequent finishes.
   1. Slab on Grade at exposed slab conditions: F_F 45, F_L 35, over test area; F_F 30, F_L 24, minimum local value.
   2. Slabs on Grade to receive thinset flooring and resilient floor covering : F_F 35, F_L 25, over test area; F_F 24, F_L 17, minimum local value.
   3. Slabs on Grade to receive carpet: F_F 25, F_L 20, over test area; F_F 17, F_L 15, minimum local value.

END OF SECTION