SECTION 03310 - CONCRETE

PART I - GENERAL

1.01 DESCRIPTION

A. The extent of concrete work is shown on drawings.

B. Concrete curbs, gutters and walkways are included.

C. Concrete curing and sealing is included.

D. Concrete equipment bases as required.

1.02 QUALITY ASSURANCE

A. Comply with the current edition of the following codes, specifications and standards:

1. ACI 301 "Specifications for Structural Concrete for Buildings".

2. ACI 302.1R "Guide for Concrete Floor and Slab Construction".

3. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete".

4. ACI 318 "Building Code Requirements for Reinforced Concrete".

5. ACI 117 "Specifications for Tolerances for Concrete Construction and Materials.

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

7. Floor slabs must be designed to support a minimum 100 PSF live load and shall not be less than 4 inches thick.

8. ASTM C-94 “Standard Specification for Ready Mix Concrete”.

9. ASTM C-157 “Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar and Concrete”.

10. ASTM E 1155-96 "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System".

11. ASTM F-710 “Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring”.

12. ASTM F-1869-98 "Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride".

13. ASTM C979-99 - Pigments for Integrally Colored Concrete.

14. ASTM E 96-00 “Standard Test Methods for Water Vapor Transmission of Materials”.

15. ASTM E 154-99 “Standard Test methods for Water Vapor Retarders Used in Contact With Earth Under Concrete Slabs”.

16. ASTM E 1643-98 “Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth of Granular Fill Under concrete Slabs”.

17. ASTM E 1745-97 “Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs”.

18. AASHTO T318 “Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying”.

B. Testing: Employ at the Contractors expense, a testing laboratory, acceptable to Walgreens, to perform the following testing. Slump, air content, water content and temperature tests must be performed with each set of compression test cylinders.

1. Compressive strength testing. Comply with ASTM C 31, ASTM C172-99, ASTM C39, and as follows:

a. Provide 4 cylinders minimum from each day's pour.

b. Provide 4 cylinders for each fifty- (50) cubic yards or fraction thereof poured on each date for slabs and foundations. Provide 3 cylinders for each one-hundred fifty (150) cubic yards or fraction thereof poured on each date for concrete paving and sidewalks.

c. Samples shall be tested and reports provided for concrete samples at 7 days, 28 days and 56 days.

2. Flatness/Levelness Testing. Comply with ASTM E-1155, but provide a minimum of one line of sampling in two perpendicular directions through each structural bay.

a. Perform testing using a "Dipstick Profiler" within 72 hours of concrete placement.

3. Concrete not conforming to Walgreens Criteria or which fails required Quality Assurance testing, including Flatness/Levelness requirements, shall be removed and replaced at Walgreens discretion.

4. Slump testing: Comply with ASTM C143.

5. Water content testing: Comply with AASHTO T318.

6. Concrete Shrinkage testing: Comply with ASTM C-157.

1.03 SUBMITTALS

A. Submit concrete mix designs to Architect/Engineer of Record for approval with copies to the Quality Control Testing Consultant.

PART II - PRODUCTS

2.01 FORMWORK

A. Construct formwork for all concrete, with plywood, metal or other panel-type materials to provide continuous, straight, smooth surfaces.

B. For site concrete: Use steel, wood or other suitable materials, free of distortion/defects of size/strength to resist movement and maintain vertical and horizontal alignment during placement.

1. Curves shall be uniform and free of form marks.

C. Form coatings: Use non-staining release agents that will not discolor, deface or impair finish or treatment of concrete.

2.02 REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, grade 60, deformed.

B. Epoxy - Coated Reinforcing Bars: ASTM A 775.

C. Welded Wire Fabric Reinforcement: ASTM A 185 welded steel wire fabric, sheets only, rolled fabric prohibited.

D. Reinforcement supports: Use chairs, spacers & bolsters complying with CRSI

1. For slabs on grade use reinforcing support to ensure proper clearance/cover. Do not pull reinforcing through placed concrete.

E. Joint Filler: Provide preformed joint filler at slab expansion joints, joints between floor slabs and walls and other isolation joints. Provide one of the following:
Precompressed, impregnated open cell foam.
Asphalt saturated fiberboard complying with ASTM D 1751.
Granulated cork between saturated felt or glass fiber felt complying with ASTM D 1752 type H.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.

B. Fly Ash: ASTM C 618, Type C or F, not to exceed 20% of cement content by weight. Do not use when ambient air temperatures are expected to be below 35 degrees F during the first 48 hours after placement.

C. Aggregates: Normal weight: ASTM C 33 Light weight: ASTM C 330. Combined aggregate gradation shall be 8% to 18% for large tip size aggregates (1 ½ inches) or 8% to 22% for smaller tip size aggregates (1 in. or ¾ in.) retained on each sieve below the top size and above the No. 100.

D. Water: Drinkable

E. Air Entraining Admixture: ASTM C 260.

F. Calcium Chloride: Any admixtures containing more than 0.1% chloride ions content by weight are not permitted.

G. Water Vapor Retarder: Decay resistant materials complying with ASTM E 96 not exceeding 0.04 perms, ASTM E 154 and ASTM E 1745 Class A. Provide polyethylene sheet not less than 15 mils thick, Raven Industries “VaporBlock 15, Stego Industries 15 mil "Stego Wrap™ or W.R. Meadows Sealtight 15 mil “Perminator®”.

H. Chemical Hardener: Colorless solution of magnesium fluosilicate, zinc fluosilicate and wetting agent containing not less than 2 lb. fluosilicates per gallon. Acceptable Products: Sonneborn, Lapidolith®, Dayton Superior, Day-Chem Hardener™.

I. Chemical Admixtures: Type A water-reducing, Type F and Type G high-range water-reducing admixtures shall comply with ASTM C494. Do not use in cold weather conditions.

2.04 CONCRETE DESIGN/PROPORTIONING

A. Provide normal weight concrete as required by drawings as follows:

1. 3,000 PSI minimum 28 day compressive strength or stronger as required by architect/engineer of record.

2. At interior slabs, provide concrete with ultimate shrinkage less than 0.05% as tested per ASTM C-157.

B. Air Entrainment: Use air-entraining admixture resulting in concrete with air content at point of placement as follows:

1. Concrete exposed to freezing/thawing, deicer chemicals, or hydraulic pressure:

4.5% (moderate exposure); 5.5% (severe exposure) 1-1/2" max. aggregate.

4.5 % (moderate exposure); 6.0% (severe exposure) 1" max. aggregate.

5.0% (moderate exposure); 6.0% (severe exposure) 3/4" max. aggregate.

5.5% (moderate exposure); 7.0% (severe exposure) 1/2" max. aggregate.

2. Other Concrete/Steel troweled interior floors: 3% maximum air.

C. Water-Cement Ratio: Provide concrete with maximum water-cement (WC) ratios as follows:

Subjected to freezing and thawing; WC 0.50. Subjected to deicers/watertight, interior floor; W/Cm 0.45.

D. Slump Limits: Provide concrete with slump at point of placement as follows:

Ramps and sloping surfaces: Not more than 3".

Reinforced foundation systems: Not less than 2" and not more than 5".

Slabs and other concrete: Not more than 5".

Concrete containing HRWR admixture shall have a maximum slump of 6". The concrete shall arrive at the job site at a slump of 2: to 3", be verified, then high-range water-reducing admixture added to increase slump to approved level.

E. Portland Cement Paving, Sidewalks and Curbs: 3,000 psi, concrete pads at drive-thru and trash areas = 4,000 psi, after 28 days curing.
Minimum thickness, 6".
Air Entrainment: 4% to 7%.
Slump: 4".
Water/Cement Ratio: Per article 2.04.C above.

F. Alternate Floor Slab Mix:
General Contractor to provide alternate bid prices for adding the following items to the mix designs.

1. 4000 ¾" no air 4" slab
Slump 3 - 5"
Entrained Air 1 – 3%
Microfibers 1.5 lbs (eliminate wire mesh)
Eclipse 1.5 gal.
Water Cement Ratio .45

2. 4000 ½" no air 5" slab
Slump 3 - 5"
Entrained Air 1 – 3%
Microfibers 1.5 lbs (eliminate wire mesh)
Eclipse 1.5 gal.
Water Cement Ratio .45

2.05 MISCELLANEOUS MATERIALS

A. Accessible Ramps: Impart color with integrally colored concrete.

1. Integral Concrete Color: Integral Red Color: (for accessible ramps) Natural or synthetic mineral oxides complying with ASTM C-979 blended at batch plant.
Acceptable Products: Bayferrox iron oxide pigment by Bayer Corp., color #110 (4 lbs.).
Davis Colors, Mix-Ready®, color Baja Red #160 (2 lbs.).
Chromix®by L.M. Scofield Co., color C-22 Coral Red.
ChemSystems, Inc., color #1345 (2 ½ lbs.)

PART III - EXECUTION

3.01 REINFORCEMENT

A. Clean reinforcement of rust, mill scale, ice or materials which will reduce bond with concrete.

B. Place reinforcement to obtain proper concrete coverage in top third of slab or 2 inches below top surface.

3.02 CONCRETE PLACEMENT

A. Place concrete on/in properly prepared sub-base or forms. Place concrete slabs directly on water vapor retarder. Provide not less than 6 inches of prepared granular substrate between water vapor retarder and ground.

1. Install water vapor retarder in compliance with ASTM E 1643.

2. Lap joints 6 in. and seal with manufacturers adhesive or tape.

3. Seal around all penetrations with manufacturers pipe boot or by wrapping with vapor retarder and taping.

4. Repair all punctures and cuts using vapor retarder material laped 6 inches beyond damaged area and taped.

5. Provide photo documentation of proper installation of vapor retarder.

B. Construct slabs to correct level, maintain reinforcing in proper position.

1. Float slabs with a highway straight edge in lieu of a conventional bull float.

C. Do not place concrete on/in frozen substrate or forms.

D. Pumping Concrete: Concrete may be placed by pumping if first approved in writing by the Architect/Engineer of Record for the proposed location. Pumped concrete shall only be placed in the presence of the Landlords Testing/Inspecting Agent.

1. Equipment: Pumping equipment shall be of the size and design that ensures a continuous flow of concrete at the delivery end without separation of materials. Do not pump concrete through aluminum pipes.

2. Concrete Mix: Shall conform to the architect of record's specified design requirements, except that mix may contain chemical admixtures to allow proper pumping. Include the specified high-range or mid-range water reducing admixture in the mix. Unless strictly controlled and anticipated in the development of the design mix, the addition of admixtures at the job should be prohibited.

3.03 JOINTS

A. Contraction joints may be formed by saw cuts within 4 to 12 hours after finishing and before random shrinkage cracks form on interior slabs. Concrete surface shall not be torn or damaged by the blade. Joints spacing shall not exceed 30 times the slab thickness in feet. Joint patterns shall be generally square. Joint depth shall be ¼" slab thickness.

B. Isolation joints: provide full depth at all locations where slabs adjoin walls, columns, foundations, drain piping, sprinkler mains, existing concrete or pavement, and other immovable objects. Provide "pinwheel" isolation joints at columns.

C. Site concrete; at concrete pavements and curbs, provide contraction joints at 12' O.C. max. Joint patterns in pavements and sidewalks shall be generally square. At curbs provide full depth expansion joints at 100-ft. O.C. max., and at locations where straight curb runs change directions. At sidewalks provide weakened plane contraction joints not more than 5'-0" max. and expansion joints at 20-ft. O.C. max. Tool all edges. Install self-leveling sealant at all isolation/expansion joints.

D. Ensure a continuous bond between adjoining paving sections. Joints shall be free of depressions and of the same texture and smoothness as the rest of the bituminous concrete course.

1. Where possible joint existing pavement with previously placed joints.

E. Sequence construction joints so that construction joints at side and end terminations of pavement are at locations where pavement operations are stopped for at least 30 minutes, unless pavement ends at an isolation joint.

1. Galvanized steel or plastic keyway-section forms or bulkhead forms with keys shall be provided unless otherwise indicated. Keys shall be embedded a minimum of 1 ½ inches into concrete.

2. Unless otherwise indicated, do not continue reinforcement through sides of pavement strips. Reinforcement shall continue across construction joints.

3. Where indicated provide tie bars at sides of pavement.

4. At places where fresh concrete is placed against hardened or partially hardened concrete surfaces use a bonding agent.

F. Where indicated form isolation joints of preformed joint-filler strips for areas abutting concrete curbs, catch basins, manholes, inlets, walks or other fixed structures.

1. Expansion joints shall be located every 20 feet.

2. Joint fillers shall extend the full width of the joint.

3. Joint filler shall terminate ½ inch below finished surface. If joint sealant is used it shall terminate one inch below the finished surface.

4. If joint sealant is not indicated, place top of joint filler flush with finished concrete surface.

5. If more than one length is required lace or clip the joint filler sections together.

6. A temporary preformed cap shall be used to protect the joint filler during concrete placement. After concrete has been placed on both sides of the joint, the protective temporary cap can be removed.

G. At joints where indicated install dowel bars and support assemblies. To prevent concrete bonding to one side of the joint lubricate or asphalt-coat ½ of the dowel length.

H. Contraction joints shall be constructed at a depth equal to at least ¼ the concrete thickness.

1. For grooved joints form contraction joints right after floating by grooving and finishing each edge of joint with groover tool to a radius of ¼ inch. After applying surface finishes repeat grooving of contraction joints. Groover marks shall be removed from concrete surfaces.

2. For sawed joints form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Joints shall be cut 1/8 inch wide into concrete when cutting action will not tear or otherwise damage surface and before the surface develops random cracks on the concrete surface.

I. Edges shall be tooled on gutters, curbs and joints in concrete after floating with an edging tool to a radius of ¼ inch. Repeat tooling of edges after applying surface finished. Tool marks shall be eliminated from concrete surfaces.

3.04 CONCRETE PLACEMENT

A. Prior to concrete placement inspect form work, reinforcement. Notify other trades to allow installation of necessary work prior to concrete placement.

B. Concrete shall not be placed on frozen surfaces. Remove any snow, ice or frost from subbase surface and reinforcement prior to concrete placement.

C. Provide a uniform dampened condition at the time of concrete placement by moistening the subbase. Concrete shall not be placed around manholes or other structures until they are at the finished elevation and alignment.

D. Follow ACI 304R for measuring, mixing, transporting and placing of concrete.

E. Water shall not be added to concrete during delivery, during placement or at the site.

F. In a continuous operation deposit and spread concrete between transverse joints. Concrete shall not be pushed or dragged into place or vibrators used to move concrete.

G. Concrete shall be consolidated by the use of mechanical vibrating equipment, additionally hand-spading, rodding or tamping may be used. Follow the procedures in ACI 309R.

H. Screed pavement surfaces with a straight edge and strike off. Begin initial floating using bull floats or darbies. A textured and uniform surface plane shall be formed before excess moisture or bleed water appears on the surface. The concrete shall not be further disturbed until finishing operations begin or spreading dry-shake surface treatments.

I. For concrete placement in separate pours, do not allow equipment on new concrete until it has attained 85% of its 28 day compressive strength.

J. Follow ACI 306.1 for cold weather placement. Frost, freezing actions or low temperatures can possibly reduce the strength or cause physical damage to the concrete. Take the following precautionary measures.

1. When the temperature is expected to fall lower than 40° F uniformly heat water and aggregates before mixing to arrive at a concrete mixture temperature of not less than 50° F and not more than 80° F at placement point.

2. Frozen materials or materials containing ice or snow shall not be used.

3. Unless approved in the mix design do not use calcium chloride, salt or other anti-freezing agents in the mix.

K. For hot weather placement follow ACI 305R.

1. The concrete mix shall be cooled to a temperature below 90° F at the time of placement. For temperature control chilled water or chopped ice may be used. The water equivalent of the ice must be calculated and subtracted from the total water amount. The Contractor may use liquid nitrogen.

2. Immediately prior to concrete placement cover steel reinforcement with water soaked burlap to reduce the steel temperature.

3. The subgrade shall be kept moist without standing water, soft spots or dry areas. Just prior to concrete placement use fog-spray on forms, reinforcement steel and subgrade.

3.05 CONCRETE FINISHING

A. Do not wet concrete surfaces during screeding, initial floating or finishing.

B. The second float finish shall begin when bleed water has disappeared on the concrete surface and the surface has stiffened enough to allow operation. The surface shall be floated either with a power-driven float or by hand if the area is small or not accessible to power units. The finish surfaces shall be true planes. High spots shall be cut down and low spots filled. The surface shall be refloated immediately to form a uniform granular texture.

3.06 CONCRETE PROTECTION AND CURING

A. In excessively hot or cold temperatures protect concrete from premature drying. Follow ACI 306.1 and ACI 305R for cold and hot weather protection respectively.

B. If surfaces are hot, dry or windy apply an evaporator retarder. Follow manufacturer's written instructions for application.

C. After finishing concrete begin curing, but not before free water has disappeared from concrete surface.

D. Cure the concrete by either moisture curing, moisture retaining cover, curing compound or any combination of these. If using a curing compound apply uniformly in a continuous operation by power spray or roller according to the manufacturer's written instructions. After a heavy rainfall re-coat if the rainfall is within 3 hours of initial application

3.07 PAVEMENT TOLERANCES

A. Follow ACI 117 for pavement tolerances.

1. Elevation tolerance is ¼ inch.

2. Thickness tolerance is plus 3/8 inch and minus ¼ inch

3. Surface tolerance gap below 10 foot long, unleveled straight edge is maximum of ¼ inch.

4. Joint spacing tolerance is 3 inches.

5. Contraction joint depth tolerance is plus ¼ inch no minus allowed.

6. Joint width tolerance is plus 1/8 inch no minus allowed.

3.08 REPAIRS AND PROTECTION

A. If any concrete pavement is broken, damaged, defective or does not meet the requirements in this section it shall be removed and replaced.

B. At the direction of the Engineer drill test cores when necessary to determine the magnitude of defective areas. In satisfactory pavement areas fill drilled core holes with portland cement concrete bonded to pavement with epoxy adhesive.

C. Do not allow traffic on pavement for at least 14 days after placement. Maintain pavement as clean as possible, remove surface stains and spills as they occur.

D. Concrete shall be swept clean not more than 2 days before substantial completion. Concrete shall be kept free of stains, discoloration, dirt and other foreign material.

3.09 FINISHING/CURING

A. Provide a floor surface which is true and level and achieves "F Numbers" of F *F* = 30 and F *L* = 20 minimum overall composite and F *F = 20* and F *L = 15* minimum at any individual section, when tested in accordance with ASTM E 1155. Remove surface irregularities to provide a continuous smooth finish free of trowel marks and trowel patterns.

B. All interior slabs to receive a smooth trowel finish,

C. Provide moisture retaining covered curing of interior slabs for 3 days minimum using cover materials that limit moisture loss to not more than 0.055 g/cubic cm in 72 hours when tested per ASTM C-156. Use cover materials that will not stain or impart any texture to the concrete surface.

D. Apply non-slip broom finish to exterior platforms, walks, steps, ramps and curbs. Tool all edges to 1/2" radius unless noted otherwise.

E. Apply concrete hardener to exposed interior floors and exterior slab at recessed entrance.

F. Floors to receive resilient flooring shall limit moisture vapor emission to not more than 3 pounds or 5 pounds per 1,000 square feet per 24 hours, depending on type of floor finish being installed, in compliance with ASTM-F- 1869.

G. Patch all form holes resulting from removal of form ties. Form ties ends shall be sealed or coated to prevent future rusting from spalling the concrete patch.

3.10 REPAIRS

A. Repair or replace broken, defective and stained concrete, and replace non-conforming concrete, all as directed by Walgreens.

END OF SECTION