ARTICLE 5. CONCRETE WORK

5.0 **APPLICABILITY**. This section applies to concrete work performed on Authority Infrastructure only. Roadway paving, curb and gutter concrete, etc. requirements within Jackson County are covered by the Jackson County UDC and fall under the authority of the Jackson County Engineer.

5.1 **GENERAL.** This section covers concrete work performed on Authority water and wastewater systems. Engineering, plans, licenses, permits, inspection, warranties and acceptance shall be as detailed in these applicable Standard Specifications.

5.1.1 **STANDARDS.** All concrete work shall meet the requirements of ACI 301, "Specification for Structural Concrete for Buildings", and ACI 347, "Recommended Practice for Concrete Formwork".

5.1.2 **SUBMITTALS.** The contractor shall submit the following items for Authority approval:

1. Concrete mix design.

2. Reinforcing shop drawings and bar schedules.

3. Batch tickets from each concrete truck showing the following information:

A. Weight and type of cement.

B. Weights of fine and coarse aggregates.

C. Weight (in gallons) of water including surface water on aggregates.

D. Quantity (cubic yards) per batch.

E. Times of batching and discharging of concrete.

F. Name of batch plant.

G. Name of contractor.

H. Type.

I. Name and amount of admixture.

J. Date and truck number.

5.2 **DESIGN CRITERIA**

5.2.1 **MIX DESIGN.** Concrete shall conform to the following requirements:

Concrete Requirements

Minimum Compressive Strength	4000 psi
Minimum Cement	6 sacks/cubic yard
Maximum Water/Cement Ratio	0.46 by weight
Slump	2-4 inches
Air Entrainment	4-8 % by Volume

5.2.2 REINFORCEMENT CLEARANCES.

Unless otherwise shown on the plans, the minimum clear cover for reinforcing steel shall be:

Location	Minimum Clear Cover
Bottom bars in soil bearing foundations and slabs 3 inches	3 inches
Bars adjacent to surfaces exposed to weather on earth backfill:	
For bars more than 3/4" in diameter 2 inches	2 inches
For bars 3/4" or less in diameter 1-1/2 inches	1 ½ inches
Interior Surfaces:	
Slabs, walls, joints with 1-3/8" diameter or smaller	¾ inches

5.3 MATERIALS.

5.3.1 GENERAL. Concrete shall be composed of Portland cement, aggregate, and water, and shall be reinforced with steel bars or steel wire fabric where required. No admixture other than air-entraining agents and water reducing agents shall be used without written permission of the Authority.

5.3.2 CEMENT. All cement used in concrete work shall be Portland cement conforming to the requirements of ASTM C-l50, II or IIA.

5.3.3 PORTLAND CEMENT CONRETE PAVEMENT—MATERIALS
Pavement requirements within Jackson County are covered by the Jackson County UDC and fall under the authority of the County Engineer. Where required by the Authority, the following minimum requirements apply for concrete pavements on JCWSA facilities where concrete pavement is specifically indicated:

A. Fine Aggregate for Concrete shall conform to the requirements of the AASHTO M 6, latest edition. The amount of deleterious substances removable by elutriation shall not exceed three percent (3%) by dry weight of fine aggregate when tested in accordance with AASHTO T 11 176 shall be eighty (80) unless otherwise specified. The fineness modules shall not be less than 2.50 or greater than 3.50 unless otherwise approved by the Engineer.

B. Coarse aggregate for concrete shall conform to the requirement of AASHTO M 80, latest edition, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO T 96. Coarse aggregate shall conform to the grading in Table 6.75.01 for the grading specified in Table 6.77.04. Sized 357 and 467 shall each be furnished in two separate sizes and combined in the plant in the proportions necessary to conform to the grading requirements. Size 357 is a combination of No. 3, No. 57, and Size No. 467 is a combination of No. 4 and No. 67.

C. Portland Cement shall conform to the requirements of the following specifications for the type specified or permitted:

Type	Specifications
Portland Cement	ASTM C 150
Types I, II, and III	AASHTO M 85
Air-entraining Portland Cement	AASHTO M 134
Masonry Cement	AASHTO M 150

In general, Type II cement shall be used in concrete which will be in contact with the soil, unless otherwise allowed or directed by the City Engineer. Unless otherwise permitted by the City Engineer, the product of only one mill of any one brand and type of Portland cement shall be used on the project, except for reduction of any excessive air-entrainment where air-entrainment cement is used. The contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which for any reason has become partially set or which contains lumps of caked cement shall be rejected. Cement salvages from discarded or used bags shall not be used.

5.3.4 FLY ASH. Fly ash may be substituted for a portion of the cement. Fly ash shall conform to the requirements of ASTM C 618.F.

Fly ash for concrete, when permitted by the Engineer, shall conform to the requirements of ASTM C 618, Table 1-a, latest edition, for Class C or Class F. (The pozzolanic activity index shall be 85 for Class C and Class F, Fly Ash.) Class C fly ash will not be permitted where sulfate-resistant cement is required.

5.3.5 WATER. Water used in mixing or curing shall be clean and free of oil, salt, acid alkali, sugar, or other substance injurious to the finished product. Water will be testing in accordance with, and shall meet, the suggested requirements of AASHTO T 26, latest edition. Water known to be of potable quality may be used without test.

5.3.6 ADMIXTURES. Air-entraining admixtures shall conform to the requirements of ASTM C-260. Chemical admixtures, if permitted by the Engineer for concrete, shall conform to the requirements of AASHTO M 194, latest edition.

5.3.7 FINE AGGREGATE. Fine aggregate shall be composed of clean, hard, durable, uncoated particles of sand, free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall be well graded from course to fine and when tested by means of laboratory sieves shall meet the following grading requirements:

Sieve Size	**Percent Passing (%)**
3/8”	100
#4	95-100
#8	80-100
#16	45-80
#30	25-60
#50	10-30
#100	2-10

Fine aggregates for concrete shall conform to the requirements of ASTM C-33.

5.3.8 COARSE AGGREGATE. Coarse aggregate shall consist of broken stone or gravel composed of clean, hard, tough and durable stone and shall be free from soft, thin, elongated or laminated pieces, disintegrated stone, clay, loam, vegetable, or other deleterious matter. Coarse aggregate shall be well graded and when tested by means of laboratory sieves shall meet the following grading requirements:

Sieve Size	Percent Passing
2"	100
1-1/2"	95 - 100
3/4"	35 - 70
3/8"	10 - 30
#4	0 – 5

Coarse aggregates for concrete shall conform to the requirements of ASTM C-33.

5.3.9 MIXING. Concrete shall be continuously mixed or agitated from the time the water is added until the time of use and shall be completely discharged from the truck mixer or truck agitator within one and one-half (l-l/2) hours after batching.

5.3.10 REINFORCING STEEL. Reinforcing bars shall conform to ASTM A615, Grade 60. Welded wire fabric shall comply with "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement" (ASTM A-l85) or "Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement" (ASTM A-497).

5.3.11 JOINT FILLER MATERIAL.

Joint materials shall conform to AASHTO Specifications according to type as follows:

Concrete joint sealer, hot-poured elastic	M l73
Preformed expansion joint filler (Bituminous Type)	M 33
Preformed sponge rubber and cork expansion joint fillers	M l53
Preformed expansion joint fillers-nonextruding & resilient bitum.	M 2l3

5.4 CONCRETE CONSTRUCTION

5.4.1 FORMWORK. Forms shall be used to confine the concrete and shape it to the required lines. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete. Forms shall be constructed so that the finished concrete shall conform to the shapes, lines, grades and dimensions indicated on the plans. Forms shall be made from plywood, coated plywood or steel.

Forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal without damaging the concrete or until the forms are not required to protect the concrete from mechanical damage. Minimum time before removal of forms after placing concrete shall be one (1) day for vertical formed surfaces. Forms supporting the

underside of beams and slabs shall not be removed until the concrete has attained the specified 28-day strength.

5.4.2 REINFORCING STEEL. Before being positioned, all reinforcing steel shall be thoroughly cleaned of mill and rust scale and of coatings that will destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary, cleaned.

Reinforcing steel shall be accurately placed and secured against displacement by using suitable tie wire or clips at bar intersections. Reinforcing steel shall be supported by metal chairs or spacers, precast mortar blocks or metal hangers. Splicing of bars will not be permitted, except where shown on the approved plans.

5.4.3 PLACING CONCRETE. Before depositing concrete, debris shall be removed from the space to be occupied by the concrete. Concrete shall not be placed until all forms and reinforcing steel have been inspected and accepted by the Authority.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods which prevent separation or loss of ingredients. The concrete shall be deposited in the forms as nearly as practicable in its final position. Concrete shall be placed in a manner that will avoid segregation and shall not be dropped freely more than five feet (5').

Concrete shall be compacted by internal vibration. Vibrators shall not be used to move or spread the concrete.

5.4.4 JOINTS. Non-bituminous joint filler shall be placed at the spacing shown on the accepted plans. Bituminous type shall be used for concrete paving where joint sealers are not specified.

5.4.5 FINISHING. Exposed faces of curbs and sidewalks shall be finished to true-line and grade as shown on the plans. Surface shall be floated to a smooth finish. Sidewalk and curb shall be broomed. After completion of brooming and before concrete has taken its initial set, all edges in contact with the forms shall be tooled with an edger having a three-eighths inch (3/8") radius.

No dusting or topping of the surface or sprinkling with water to facilitate finishing will be permitted.

Immediately following the removal of the forms, all fins and irregular projections shall be removed from all surfaces. Surface defects, including tie holes shall be patched. The surface shall be left sound, smooth, even, and uniform in color.

5.4.6 CURING. Fresh concrete shall be adequately protected from weather damage and mechanical injury during the curing periods. The curing process shall be started as soon as possible after concrete placement and finishing and shall continue for a minimum of seven days. The following curing procedures may be used:

1. Ponding (for slabs or footings).

2. Spraying with a membrane curing compound.

3. Wet burlap, earth, or cotton mats.

4. Waterproof paper or polyethylene plastic cover.

5.4.7 COLD WEATHER CONCRETING. Concrete placement during cold weather shall conform to the requirements of ACI 306, "Recommended Practice for Cold Weather Concreting".

Concrete placed in cold weather shall be protected from extreme temperatures as follows:

1. A temperature of at least 50 degrees F shall be maintained for the first seventy-two (72) hours after placement.

2. After the first seventy-two (72) hours and until the concrete is seven (7) days old, it shall be protected from freezing temperatures.

3. Concrete adjacent to heaters shall be insulated from direct heat of the unit that may dry it out prior to being properly cured.

2. Temperatures shall be measured by maximum and minimum thermometers furnished by the Contractor and installed adjacent to the concrete.

Concrete slabs shall not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost.

5.4.8 HOT WEATHER CONCRETING. The placement of concrete in hot weather shall comply with ACI 305, "Recommended Practice for Hot Weather Concreting".

5.4.9 BACKFILLING. Backfill shall not be place against concrete structures until the concrete has attained its specified 28- day strength.

5.4.10 TESTING. All concrete used on Authority structures shall be sampled and tested by an approved testing agency. Test reports shall include the exact location of the work at which the batch represented by a test was deposited. The report of the strength test shall include detailed information on storage and curing of specimen prior to testing, the project number, and the location of the concrete. All test reports shall bear the seal and signature of a professional Engineer registered in the state of Georgia and competent in the field of concrete testing.

One series of strength tests shall be taken per fifty (50) cubic yards (or fraction thereof) of the concrete placed per day. Slump tests, air tests, and unit weight tests shall be performed on each truckload of concrete.