PART 1 GENERAL

1.1 SCOPE:

A. This section includes work necessary for furnishing and placing ready-mix concrete, freshly mixed and unhardened state as hereinafter specified.

B. In the event these specifications lack direction or a situation arises not covered herein ACI 318 and/or ACI 304R shall prevail.

PART 2 PRODUCTS

2.1 CONCRETE:

A. Ready-mixed meeting ASTM C94, Option A (Contractor shall submit a mix design for approval by the Engineer).

B. Minimum allowable 28-day compressive field strength shall be 3,500 PSI or as specified for the type of structure under consideration and called for in the Plans.

C. When specified "High Early Strength" provide a Type III or IIIA mix that will achieve required/specified strength in 3-days

2.2 AGGREGATE:

A. Aggregates shall conform to ASTM C33 and for lightweight aggregates ASTM C330.

2.3 WATER:

A. Water shall be clean and free from injurious substances deleterious to concrete and reinforcement.

B. Reclaimed water, if used, shall meet current codes.

C. Maximum water-cement ratios;

Compressive Strength (pcf)	Non-Air-Entrained	Air-Entrained
3000	0.58	0.46
3500	0.51	0.40
4000	0.44	0.35
4500	0.38	*
5000+	* Based upon trial mixtures.	

2.4 CEMENTS

A. Portland cement shall conform to ASTM C150 and be one of five types: Type I, II, IIA, III, IIIA, IV, or V. Blended cements (hydraulic cements) shall conform to ASTM C595 and be one of the five classes as follows;

1.	Type IS	Portland blast-furnace slag cement;
2.	Type IP and Type P	Portland-pozzolan cement;
3.	Type S	Slag cement;
4.	Type I (PM)	Pozzolan-modified portland cement; and
5.	Type I (SM)	Slag-modified portland cement.

B. Blended cements manufactured under ASTM C1157 must be approved by the Engineer on a case-by-case basis. If allowed they shall conform to the following types;

1.	Type GH	General purpose
2.	Type HE	High early strength
3.	Type MS	Moderate sulfate resistance
4.	Type HS	High sulfate resistance
5.	Type MH	Moderate heat of hydration
6.	Type LH	Low heat of hydration

2.5 REINFORCEMENT:

A. Reinforcing steel shall conform to SECTION 2100, of these specifications.

2.6 ADMIXTURES:

A. Admixtures shall be submitted for approval in the mix-design.

B. Admixtures shall conform to the following:

1.	Air-Entraining admixtures	ASTM C260
2.	Water-Reducing and Accelerating admixtures	ASTM C494
3.	Pozzolans	ASTM C618
4.	Slag	ASTM C989
5.	Silica Fume	ASTM C1240

C. Miscellaneous unregulated admixtures may be approved on a case-by-case basis by the engineer.

2.7 FORMS:

A. Make all forms mortar-tight, set them so finished concrete will conform to proper dimensions and contours, and make them sufficiently rigid to prevent distortion due to pressure of the concrete and other loads incidental to construction operations. Construct and maintain forms to prevent warping and opening of joints.

B. Design forms to withstand effect of vibration of concrete as it is placed.

C. Make wood forms for concrete surfaces, to be exposed to view, of dressed lumber of uniform thickness. Shiplap or S4S boards are acceptable provided forms are mortar-tight. Plywood will be acceptable as a form liner if supported in an approved manner. Ensure that all formwork for exposed concrete surfaces is smooth with grain running in the same direction to give a good finished appearance. Construct metal ties or anchorages within forms to permit their removal to a depth at least 1-inch from face without injury to concrete. Where wire ties are permitted, all wires, upon removal of forms, shall be cut back at least 1/4-inch from face of concrete with chisels or nippers; for green concrete, mopers are necessary. Design all fittings for metal ties so that, upon their removal, cavities that are left will be of smallest possible size. Fill cavities with cement mortar and leave surface sound, smooth, even and uniform.

2.8 EXPANSION/CONTRACTION JOINT MATERIAL:

A. When specified for concrete structure to have joint material it shall conform to the following;

1. PREFORMED JOINT FILLERS: Preformed joint fillers shall conform to AASHTO M153 or AASHTO M213 except that those furnished under AASHTO M213 shall be tested in accordance with ASTM D1751.

2. PREFORMED ELASTOMERIC JOINT SEALS: Preformed elastomeric joint seals shall conform to AASHTO M220.

3. POURED FILLER: Poured filler for concrete joints shall conform to AASHTO M173.

2.9 CURING MATERIALS:

A. Curing materials shall conform to the following requirements:
> White Polyethylene Film For Curing Concrete: AASHTO M171
> Liquid Membrane-Forming Compounds for Curing AASHTO M148

PART 3 EXECUTION

3.1 PREPARATION OF BASE:

A. Before paving or placing operations begin, the base shall be brought to finished condition, surface compacted, and dampened.

B. Manholes, inlets, catch basins, drains, and all other structures shall be completed, adjusted, cured, and otherwise prepared, as applicable, and made clean and ready to have concrete placed in contact with them.

C. For PCC paving, manholes frames and other independent metal structures in the pavement area shall be prepared with an approved bond-preventing agent.

3.2 PLACING REINFORCING STEEL:

A. Place reinforcing steel as shown and in accordance with CRSI recommended practice for placing bars, and in conformance with SECTION 2100 of these Specifications.

3.3 FORM WORK:

A. Keep forms in place until concrete has reached a theoretical strength of 1,000 psi. When forms appear to be unsatisfactory in any way, either before or during placing of concrete, work may be ordered stopped until defects have been corrected.

B. Maintain shape, strength, rigidity, water-tightness, and surface smoothness of re-used forms at all times. Do not re-use warped or bulged lumber, and do not re-use any forms which, in the opinion of the Engineer, are unsatisfactory in any respect. Thoroughly clean re-used forms of all dirt, mortar, and foreign matter.

C. Treat all forms with an approved form oil or wax or saturate with water immediately before placing concrete. Do not use material, which will adhere to or discolor concrete.

3.4 MIXING AND DELIVERY:

A. Mixing and delivery shall be in conformance to ASTM C94 and sampling by Alternative No.2.

1. As mixer is being emptied, individual samples shall be taken after discharge of approximately 15-percent and 85-percent of the load.

B. Mixing time shall conform to ASTM C94 of between 12 and 18rpm.

C. Mixing time shall not exceed ASTM C94 of 1-1/2 hours or 300 revolutions, whichever comes first.

D. WATER: Water shall not be added to mix at the job site unless a slump test has been conducted and indicates the mix delivered is less then min slump of the mix-design. Water maybe added at that time only and only once. The drum shall be turned at least 30 times once water is added prior to placing mud. The batch ticket shall be modified to indicate the amount of water added.

E. TEMPERATURE: Mix delivered to job site shall have a minimum temperature of 50^{O}F and a shall not exceed a maximum of 90^{O}F.

3.5 PLACING CONCRETE:

A. Do not place concrete without the approval of the engineer. Concrete placed without engineer's approval may be rejected and removal required.

B. In preparation for placing of concrete, remove all sawdust, chips, blocks, and other construction debris and extraneous matter from interior of forms. Remove struts, stays, and braces, serving temporarily

3.6 COMPACTION AND CONSOLIDATION:

A. During placement, the concrete shall be thoroughly consolidated to develop a cohesive mass that fills all voids in the formwork. Apply approved vibrator to concrete to accomplish a well-mixed, cohesive mass. Do not spread vibrating points any further than maximum effective radius.

3.7 FORM REMOVAL:

A. Contractor shall assume full responsibility for all damage resulting from premature removal of forms. Do not place backfill against walls below grade, and do not remove forms and shoring from below grade structural slabs or beams until concrete has reached an actual field strength equal to 75-percent of the specified 28-day design field strength. Actual field strength shall be determined from field cured test cylinders, which shall be cured under conditions equivalent to the most unfavorable conditions for the portions of concrete, which the cylinders represent.

B. Do not use methods of form removal likely to cause over-stressing of concrete. Do not remove forms and their supports without approval. Remove supports in such a manner as to permit concrete to uniformity and gradually take the stress due to its own weight.

C. After forms have been removed, carefully point, with mortar, all depressions resulting from removal of form ties or other causes.

3.8 SURFACE FINISHING:

A. Concrete shall be screeded off, bullfloated and edge shined (when required) as shown on the Plans.

3.9 JOINTS:

A. CONSTRUCTION JOINTS:

1. Provide construction joints at locations and manner detailed on plans. Work shall be planned in advance to place pour to construction joints for a days work. No construction joint shall be placed without the approval of the Engineer.

B. CONTRACTION/EXPANSION JOINTS.

1. Provide contraction/expansion joints at locations called out on the Plans.

2. Contraction/expansion joints shall a minimum of 2/3 of the thickness.

3. Premolded joint filler as specified in sub-section 2.8 shall be used in contraction/expansion joints that occur between existing and new concrete surfaces such as vaults, manholes, columns, footings and the like and/or as located by call out on the Plans.

C. MISCELLANEOUS JOINT REQUIREMENTS.

1. Cut back existing curbs, walks, driveways, and other such structures to permit the new construction and where the new structures are to be constructed against or within 6-inches (min.) of the end, edge, or side of structures, the construction shall include the construction of approved connections therewith, using the same kind of concrete as is used in the new construction. Make the joint between the old and new material with a saw cut.

3.10 CURING:

A. Keep concrete continuously wet for 7-day period. Intermittent wetting is not acceptable.

B. Contractor can additionally use curing compound to keep concrete wet. Compound use shall be at the discretion of the Contractor, with an approved compound and applied as follows:

1. LIQUID MEMBRANE FORMING COMPOUNDS - Liquid membrane forming compounds shall be applied uniformly to the damp concrete by pressure-spray methods at the Manufacturer's recommended rate. The compound shall form an impervious membrane when tested in accordance with ODOT TM 721.

2. POLYETHYLENE FILM - White or clear polyethylene film, a minimum of 4-mils in thickness, shall be applied to damp concrete as soon as the film can be placed without marring or discoloring the surface. The membrane shall be placed in contact with the surface, shall extend beyond the sides or edges of the slabs or forms, and shall be held in position to maintain a moisture proof covering. Laps shall be sufficient to maintain waterproofing equivalent to the sheeting.

3.11 WEATHER LIMITATIONS:

A. Contractor shall assume full responsibility for the concrete work during unusual weather conditions including but not limited to hot and cold weather. Any work not in conformance to the Plans and Specifications may be rejected by the Engineer and replaced and/or repaired at the contractor’s expense.

3.12 DEFACEMENT OF CONCRETE:

A. Contractor shall be responsible for the first 48-hours of concrete structure to ensure defacement does not occur. Repair shall be at the expense of the Contractor.

3.13 MEASUREMENT AND PAYMENT:

A. Placed redi-mix will be field measured and quantified for the specific end use product built (i.e. sidewalk, slab, thrust block, curb, etc.)

3.14 SUBMITTAL REQUIREMENTS:

A. Submit the following as a minimum.

1. Current Mix-Design specifically for this project including any and all admixtures.
2. Catalog cut sheets on curing compound.
3. Catalog cut sheets on joint filler material – when required.

PART 4 TESTING

4.1 FIELD TESTS

A. The Engineer may have test cylinders taken and tested by an approved testing laboratory to verify concrete strength at his discretion.

B. Acceptance and evaluation of concrete properties and characteristics in accordance with the relative ASTM standard and/or ACI 318.

END OF SECTION