

SECTION 091
SPECIFICATIONS - CONCRETE

1.0 Concrete

All concrete structures shall comply with the following:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete";
2. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete";
3. ACI 311.4R, "Guide for Concrete Inspection";
4. ACI 311.5, "Guide for Concrete Plant Inspection and Field Testing of Ready-Mixed Concrete";
5. ACI 318/318R "Building Code Requirements for Structural Concrete and Commentary";
6. ACI 347R, "Guide to Formwork for Concrete";
7. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice";
8. Illinois Department of Transportation (IDOT), Standard Specifications for Road and Bridge Construction; latest edition.

Upon request of the Engineer, two (2) sets of reinforced steel fabrication drawings shall be submitted to the Engineer for review.

The IDOT Specifications, except when specifically preempted by directions of the Engineer, shall govern all aspects of concrete work, except for those articles regarding methods of measurement and basis of payment.

In cases of conflict between the IDOT specifications and other specifications noted above, the Engineer shall resolve the conflict, exclusively. The Contractor shall not make any claims for additional compensation due to discrepancies between specifications.

2.0 Materials

1. Portland Cement - shall conform to ASTM C-150, Type 1, Type 1A or Type 3. Substitutes shall not be allowed for Portland cement unless approved by the Engineer.
2. Aggregates - Fine aggregates shall conform to Section 1003, and coarse aggregate shall conform to Section 1004, of the IDOT Standard Specifications for Road and Bridge Construction, latest edition.
3. Reinforcing Steel
 - A. Reinforcement bars shall be in accordance with ASTM A615, Grade Sixty (60) deformed bars, except as otherwise indicated. Epoxy coating of reinforced steel bars shall be in accordance with ASTM A775.
 - B. Smooth dowels shall be in accordance with A615, Grade Sixty (60) plain bars.
 - C. Threaded dowels shall be in accordance with ASTM A36.

- D. Steel-welded, plain wire fabric shall be in conformance to ASTM A185 and ASTM A82.
4. Water used in all concrete mixes shall be potable water.
 5. Admixtures shall be used only with the approval of the Engineer or his Representative and in accordance with the IDOT Standard Specifications for Road and Bridge Construction, latest edition.

3.0 Concrete Proportioning

Concrete shall be air-entrained, and proportioned to obtain the following criteria:

	<u>Use of Concrete</u>	<u>Compressive Strength, Min. (PSI)</u>	<u>Air-Entrained (by volume)</u>	<u>Slump</u>
1.	Fill	2500 (@ 14 days)	3½% to 6½%	1" min. to 4" max.
2.	Structural	4000 (@ 14 days)	5.0% to 7.0%	2" min. to 4" max.
3.	Encasement, sidewalk, curb, gutter, median	3500 (@14 days)	5.0% to 8.0%	2" min. to 4" max.
4.	Base course, pavement, driveway	3500 (@ 14 days)	5.0% to 8.0%	¾" min to 1½" max.

The Engineer may request the Contractor to supply test data to verify the concrete supplier is capable of producing the specified strength. The Contractor shall specify that concrete mixtures be proportioned such that they shall satisfy the requirements of these specification and those of the IDOT Standard Specifications.

At his discretion, the Engineer may specify that the Contractor use a different concrete mix, consisting of altering the materials used or the proportion thereof and/or specifying the addition or removal of admixtures. At locations specified by the Engineer, the Contractor shall use the special patching mixture given in Section 1020.05(g)(2) of the IDOT Standard Specifications. The Contractor shall not claim any additional compensation for the adjustment of the concrete mixes by the Engineer.

4.0 Quality Control Testing

At the discretion of the Engineer, the Contractor shall employ a testing laboratory to perform quality control testing. Both the choice of tests performed, and the frequency thereof, shall be the decision of the Engineer exclusively. The results of testing shall be in accordance with the requirements of IDOT Standards and these specifications.

The Engineer may require the following tests:

1. Sampling Freshly Mixed Concrete, ASTM C172;
2. Standard Specification for Ready-Mix Concrete, ASTM C94;
3. Standard Test Method for Slump of Hydraulic-Cement Concrete, ASTM C143/C143M;

4. Standard Test Method for Air Content of Freshly Mixed Concrete by Pressure Method, ASTM C231;
5. Standard Test Method for Temperature of Freshly Mixed Portland cement Concrete, ASTM C1064;
6. Standard Practice for Making and Curing Concrete Test Specimens in the Field, ASTM C31/C31M;
7. Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, ASTM C39.

For compressive strength testing, not less than three (3) cylinders shall be made for each twenty (20) cu. yds. of concrete or fraction thereof in each days pour, except that in no case shall a given mix design be represented by less than three cylinders. The Engineer or the Contractor may request extra cylinders be made and tested for the purpose of indicating sufficient concrete strength for form removal or other purposes. If additional testing is required to verify a compressive strength as listed in ASTM C-42, "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" the Contractor will do so at his own expense. Should the concrete still fail to meet the design strength, the Contractor shall remove, replace and retest at his own expense.

Test results shall be the property of the Engineer and presented to him in writing as soon as the tests are completed. If sampling from a mix fails any test performed, the Contractor shall be responsible for either correcting the failure or rejecting the mix for use. Any additional costs associated with testing, altering a batch of concrete so that it meets the requirements of these specifications or rejection of an inadequate batch shall be the exclusive responsibility of the Contractor. Any costs associated with sample testing, or the removal and replacement of poured concrete that fails any testing required shall also be the exclusive responsibility of the Contractor.

5.0 Mixing and Placing Concrete

Contractor shall notify the Engineer or his Representative twenty-four (24) hours in advance of the commencement of the placing of concrete to set up an inspection of in-place items such as formwork, reinforcement, joints, etc.

Aggregate to be used in concrete shall be handled, mixed and batched in accordance with the IDOT Standard Specifications. Concrete shall be mixed, hauled and placed also in accordance to the IDOT Specifications and ACI 304R "Guide for Measuring, Mixing, Transporting, and Placing Concrete ". The mixing and preparation of concrete shall be performed at a ready-mix plant and not at a mobile Portland cement concrete plant unless approved by the Engineer.

The Contractor shall instruct haulers of concrete to clean the truck mixers at a location specified by the Engineer or his Representative.

6.0 Finishing Concrete

Unless specified otherwise by the Engineer, finishing of concrete pavement surfaces shall be in accordance with Section 442 of the IDOT Specifications. Surface testing, also in accordance with IDOT Specifications, may be required at the discretion of the Engineer.

For concrete surfaces not exposed to view, such as the concrete encasement of specified sewer pipe, a rough form finish, in accordance with ACI 301 shall be applied. The concrete shall have a surface texture

imparted by the formwork. All tie holes and defective areas shall be repaired and patched and pins and other projections shall be removed. Chip or rub off fins exceeding ½" in height. The Engineer will specify where concrete is to be finished in this manner.

Concrete sidewalk surfaces shall be finished in accordance with Section 424.06 of the IDOT Specifications unless conflicting with those of an agency having jurisdiction over the right-of-way in question.

Concrete driveways shall receive a smooth-form finish in accordance with ACI 301. A smooth-form finish shall be applied to monolithic slab surfaces that are to be exposed to view unless otherwise shown on the drawings. Such surfaces shall receive a final broom finish. The Engineer shall decide the amount of broom finish texture required.

7.0 Curing Methods

Curing of all poured concrete surfaces, including driveways, sidewalks, pavement and base courses, shall be done in accordance with Article 1020.13 of the IDOT Specifications. The Contractor shall select the method of curing with the approval of the Engineer.

At those locations where a high-early strength concrete mixture is specified, the Engineer or his Representative shall specify the curing time.

8.0 Miscellaneous Items

Water stop as called for on the drawing shall be PVC waterstops, four (4) inches wide by 3/16" thick with longitudinal ribs and a hollow center bulb running the length of the waterstop, as manufactured by the W.R. Grace & Co.

Concrete anchoring systems shall be Trubolt Wedge Anchors, Type 316 stainless steel, part of the Red Head Concrete Anchoring Systems manufactured by Illinois Tool Works (ITW), Inc., or an equal approved by the Engineer before the opening of project bids. On the plan sheets, the Engineer shall specify which type of anchor shall be used as well as the thread length and anchor diameter. Alternative anchoring systems shall be used as specified on the plan sheets by the Engineer.

At the discretion of the Engineer, Concrete anchoring shall be coupled with an adhesive anchoring system to provide additional reliability. Adhesive anchoring systems shall be EPCON, two-part epoxy, Adhesive Anchoring Systems as manufactured by ITW, Inc., or an equal approved by the Engineer before the opening of project bids. The Engineer shall specify which EPCON product system to be used.

Capsule anchors shall be of the size and length required as outlined on the Plans and Specifications and shown on the Shop Drawing unless otherwise stated. Anchors shall be Molly Parabol type M24-1, Ramset Chemset CTR10 or equal. Installation shall be per manufacturer's recommendations.

END OF SECTION