

TECHNICAL SPECIFICATIONS
FOR
PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN)

1. Description

This work shall consist of a pavement composed of portland cement concrete constructed on a prepared roadbed in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross-sections shown on the Plans or established by the Engineer.

2. Materials

(a) Concrete

Concrete shall be composed of portland cement, aggregates, and water. Air-entrainment shall be provided by adding an air-entraining agent.

(b) Portland Cement

Portland cement shall conform to AASHTO M85 or ASTM C150. The cement used in the work shall correspond to that on which selection of concrete proportions was based.

When Types IV and V cements are used, proper recognition shall be given to the effects of slower strength gain and lower heat of hydration on concrete proportioning and construction practices.

The Contractor shall provide suitable means for storing and protecting the cement against dampness. Cement, that for any reason has become partially set or which contains lumps of caked cement shall be rejected.

(c) Aggregates

Fine aggregate for concrete shall conform to the requirements of Subsection 903.01 of TDOTSS, 1995. Coarse aggregate for concrete shall conform to the requirements of Subsection 903.03 of TDOTSS, 1995.

Fine aggregate manufactured from limestone or other polishing aggregate will not be permitted in traffic lanes.

(d) Water

Water used in mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter, or other substance injurious to the finished product. Water shall be tested in accordance with and shall meet the requirements of AASHTO T26. Water known to be potable may be used without test.

(e) Admixtures

No admixtures shall be used in the concrete without prior approval, and all approved admixtures shall conform to applicable AASHTO and ASTM requirements.

Air-entraining agents shall conform to AASHTO M154 and shall have proven compatibility with all local concrete materials, including cement, and shall be capable of providing in the concrete the required air contents and an air-void system known to produce durable, scale resistant concrete.

Admixtures other than air-entraining agents shall not be used until trial mixes with job materials have shown them to be compatible at job temperatures. Trial mixes must also show that desired properties will be imparted to the fresh concrete without any subsequent loss of strength or durability in the hardened concrete.

(f) Steel

Unless otherwise specified, all steel reinforcement for concrete shall meet the requirements of TDOTSS, 1995.

(g) Joint Materials

Unless otherwise specified or requested by the Engineer, poured sealer for joints shall conform to the requirements of Subsection 905.05 of TDOTSS, 1995, for Hot Poured Elastic Type Sealant.

Preformed fillers for joints shall meet the requirements of Subsection 905.01 of TDOTSS, 1995.

(h) Curing materials

Curing materials shall conform to the requirements of Section 913 of TDOTSS, 1995.

3. Proportioning

Unless otherwise provided herein, each cubic yard of concrete shall contain a minimum of 470 lb. of cement, and the water-cement ratio by weight shall not exceed 0.50. An air-entraining agent shall be used to produce an air content of 5 ½%, plus or minus 1%, by volume of concrete as determined by AASHTO T152.

After the materials have been accepted by the Engineer, they shall be so proportioned as to produce a workable concrete having a maximum slump of 3 in. for vibrated placement or 1 in. for slip-formed placement as determined by AASHTO T119. The concrete shall have a flexural strength at 14 days of not less than 550 pounds per square inch when tested in accordance with AASHTO T97, or a compressive strength of 3,500 pounds per square inch when tested in accordance with AASHTO T22.

The Contractor shall submit a job-mix design and certified test reports indicating compliance of the materials to the applicable specifications in 2. and the job mix to those listed above. Such design and reports shall be submitted in duplicate to the Engineer and other such agencies or persons he may designate well in advance of the time scheduled for starting the work. The Engineer must approve such information before starting concrete operations. Reports or certificates indicating compliance of any shipment of materials shall be placed in the hands of, and approved by the Engineer, prior to use of such materials. The cost of testing materials and the job-mix design shall be borne by the Contractor.

Where reputable materials suppliers maintain regular recognized testing services, certified copies of such tests will be accepted by the Engineer. However, in any case of doubt as to the accuracy and/or adequacy of such tests, the Engineer may require that materials be tested by a recognized commercial testing laboratory which has been selected by the Contractor and approved by the Engineer. The testing laboratory shall then test the cement and aggregates and prepare written reports showing the results of such tests on each shipment. The laboratory shall also certify that the materials covered by the report comply in all respects with these Specifications. In general, materials shall be tested by the manufacturer/producer, but if untested shipments require sampling and testing after arrival at the site of work, the Contractor shall be fully responsible for delays in the progress of the work due to delays in testing and reporting.

If it is impossible to obtain concrete of the desired plasticity and workability with the proportions originally designated, the Engineer shall change aggregate weights as required, maintaining the cement content originally designated. No change in the sources or character of the materials shall be made without due notice to the Engineer.

4. Equipment

All the equipment necessary for the construction shall be approved by the Engineer before the work will be permitted to begin. The equipment shall meet the requirements of Subsection 501.04 of TDOTSS, 1995.

5. Construction Requirements

(a) Subgrade Preparation

Subgrade preparation shall be performed as provided for under Section 4.0 of these Specifications.

(b) Construction of Base

The base course, if required by the plans, shall be constructed in accordance with Section 5.0 of these Specifications and the requirements listed:

- 1) The Contractor shall be responsible for constructing or correcting the base to such grade tolerances as will insure the concrete pavement thickness required.
- 2) The base shall be completed not less than 500 linear feet in advance of the paving unless otherwise authorized by the Engineer.
- 3) The base shall be in a moist condition at the time of placing concrete. If it becomes dry prior to the actual placing of the concrete, it shall be sprinkled, but the formation of pools of water shall be avoided. The base shall not be muddy or soft.

(c) Setting Forms

Forms shall be set in accordance with the requirements of Subsection 501.07 of TDOTSS, 1995. In lieu of setting forms, the edge of a previously placed curb and gutter section may be used as a form if approved by the Engineer.

(d) Handling, Measuring, and Batching Materials

All handling, measuring, and batching of materials shall be performed in accordance with the requirements of Subsection 501.09 of TDOTSS, 1995.

(e) Mixing Concrete

Concrete shall be mixed in accordance with the requirements of Subsection 501.10 of TDOTSS, 1995, with the limitations of Subsection 501.11 of TDOTSS, 1995.

(f) Placing Concrete

Concrete shall be placed in accordance with Subsection 501.12 of TDOTSS, 1995, except as herein noted.

Paragraphs one, three, and five of Subsection 501.12 of TDOTSS, 1995, shall be deleted and the following added:

- 1) The mechanical spreader may not be required at the discretion of the Engineer.
- 2) All concrete placed shall be vibrated. The use of hand vibrators will only be permitted at the discretion of the Engineer. Vibrators mounted on a machine shall be operated only while the machine is in motion.

(g) Test Specimens

The Contractor shall furnish the concrete necessary for casting test specimens in the field and shall provide water-tight tanks of satisfactory size and number to accommodate the test specimens. The Engineer will designate the frequency of sampling the fresh concrete and will prepare the test specimens. The method of making and curing test specimens will be in accordance with AASHTO T23. The cost of testing shall be borne by the City of Knoxville.

(h) Strike-Off, Consolidation, and Finishing

The strike-off, consolidation, and finishing of the concrete shall be performed in accordance with Subsection 501.16 of TDOTSS, 1995, and the following.

The Contractor shall always have available materials to protect the surface of the plastic concrete against rain. These materials shall consist of burlap, curing paper, or plastic sheeting. When slip-form construction is being used, materials such as wood planks or forms to protect the edges of the pavement shall also be required.

Transverse grooving after the burlap drag finishing shall not be required unless shown in the plans or directed by the Engineer.

(i) Surface Test

The pavement surface shall be tested in accordance with Subsection 501.17 of TDOTSS, 1995.

(j) Curing

Curing operations shall be done in accordance with Subsection 501.18 of TDOTSS, 1995, except as follows.

Membrane curing will not be permitted in frost-affected areas or paving that will be exposed to deicing chemicals within 30 days after completion of the curing period.

(k) Removal of Forms

Removal of the concrete forms shall meet the requirements of Subsection 501.19 of TDOTSS, 1995.

(l) Joints

Joints shall be constructed of the type and dimensions, and at the locations required by the plans, and in accordance with the provisions of the Specifications.

Longitudinal joints shall be perpendicular to the pavement surface and shall be along or parallel to the centerline of the pavement, unless otherwise specified. Transverse joints shall be straight, vertical to the pavement surface and shall be at the angle to the centerline of the pavement as shown on the Plans.

1) Transverse Contraction Joints

Transverse contraction joints shall be placed at the intervals and dimensions specified and shall be of the plain sawed groove type as detailed on the Plans and in accordance with these Specifications.

Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually six to twelve hours. All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. The sawing of a joint shall be discontinued when a crack develops ahead of the saw. In general, all joints shall be sawed in sequence.

All contraction joints in lanes adjacent to previously constructed lanes shall be sawed before uncontrolled cracking occurs. If extreme conditions exist which makes it impractical to prevent erratic cracking by early sawing, a contraction joint groove shall be formed at intervals of every third or fourth joint, or as often as required prior to initial set of concrete by placing inserts in the plastic concrete at the angle to the centerline of the pavement indicated on the plans and perpendicular to the surface. When the concrete has attained its initial set and after the joint has been carefully finished, the insert shall be removed. The groove so formed shall maintain its full width and depth as shown on the Plans, and the pavement at the joint shall meet surface requirements.

Immediately after sawing, the joints shall be cleaned of all residue by flushing with water under pressure.

2) Transverse Construction Joints

Transverse construction joints of the type shown in the plans shall be placed whenever the placing of concrete is suspended for more than 30 minutes. A butt joint with dowels shall be used if the joint occurs at the location of a contraction joint. Keyed joints with tie bars shall be used if the joint occurs at any other location.

3) Transverse Expansion Joints

Transverse expansion joints shall consist of a vertical expansion joint filler placed on a butt-type joint with dowel bars as shown in the plans. The expansion joint filler shall be continuous from form to form for the full depth of the pavement and shaped to the subgrade, curb section, and to the key way along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used unless approved by the Engineer.

The expansion joint filler shall be held in a vertical position. An approved installing bar or other device shall be used if necessary to ensure proper grade and alignment during placing and finishing of the concrete.

Finished joints shall not deviate in horizontal alignment more than 1/4 in. from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. The top edge of the filler shall be protected, while the concrete is being placed, by an approved metal channel cap. Dowels shall be held in position, parallel to the surface and centerline of the slab, by an approved metal device that is left in the slab. Dowels that are not corrosion-resistant shall be painted with one coat of approved primer. When the paint has dried and immediately before placing the dowel in position, the sleeve-end of the dowel shall be thoroughly greased. Bond breaker for corrosion-resistant dowels shall be as recommended by the coating manufacturer.

4) Longitudinal Joints

Longitudinal joints shall be constructed by forming a keyed butt-type joint or sawing a groove in the surface of the pavement as detailed in the Plans.

If required by the Plans, deformed steel tie bars of specified length, size, spacing, and materials shall be placed across and perpendicular to the longitudinal joints. They shall be placed by approved mechanical equipment or rigidly secured by chairs, or other approved mechanical equipment, or rigidly secured by chairs or other approved supports to prevent displacement.

When adjacent lanes of pavement are constructed separately, a key-way shall be formed along the construction joint of the first lane constructed by any method approved by the Engineer and to the dimensions shown on the Plans. If required, tie bars may be bent at

right angles against the form and straightened into final position before the concrete of the adjacent lane is placed, or they may be placed in holes drilled through the forms.

Longitudinal sawed joints shall be cut by means of approved concrete saws to the depth, width and line shown on the Plans, not later than 4 days after placing concrete and before any equipment or vehicles are allowed on the pavement.

Immediately after sawing, all longitudinal contraction and construction joints shall be thoroughly cleaned of all residue by flushing with water under pressure.

5) Isolation Joints

Expansion joints shall be formed about all structures and features projecting through, into or against the slab by the use of premolded joint filler. Unless otherwise indicated, such joints shall be 3/4 inch in width.

(m) Sealing Joints

Joints shall be sealed in accordance with the requirements of Subsection 501.20 of TDOTSS, 1995.

(n) Protection of Pavement

The pavement shall be protected in accordance with the provisions of Subsection 501.21 of TDOTSS, 1995.

(o) Opening to Traffic

The Engineer shall decide when the pavement shall be opened to traffic. It shall not be opened to traffic until the field-cured concrete has attained a flexural strength of 550 psi, or a compressive strength of 3,500 psi. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Before opening to traffic, the pavement shall be cleaned.

6. Method of Measurement

The quantity of pavement laid shall be the number of square yards of full-depth pavement. The number of square yards shall be determined by the Engineer after construction of the pavement has been completed.

7. Basis of Payment

The accepted quantities of concrete pavement will be paid for the contract unit price per square yard for the specified thickness for Portland Cement Concrete Pavement (Plain). Payment shall constitute full compensation for furnishing and preparation of all materials, including all joints, joint fillers, dowels and reinforcing if required in the construction drawings or special provisions; placing, finishing, curing; and all labor, equipment, tools incidentals, and testing necessary to complete these items. No additional payment over the contract unit bid price will be made for pavement which has an average thickness in excess of that shown on the Plans.