

CITY OF DUNCAN, OKLAHOMA  
SPECIFICATION #74-400  
STANDARD CONSTRUCTION  
SPECIFICATIONS  
P.C. CONCRETE PAVING

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74-400-01. PORTLAND CEMENT CONCRETE PAVING.

a) DESCRIPTION. This item will consist of all the required excavation, the removal, proper utilization or disposal of all excavated materials and the construction of all embankments, and the shaping and finishing of all earthwork in conformity with the lines and grades as shown on the plans or established by the Engineer.

b) EXCAVATION. All excavation shall be in accordance with the lines, grades and typical sections as shown on the plans or established by the Engineer. Street excavation will be made to the subgrade of the roadway and finished grade of parkways.

Where excavation to grades established in the field by the Engineer would terminate in unstable soil, the Engineer may require the Contractor to remove the unstable soil and backfill to the required grade with suitable material compacted in an approved manner to a satisfactory density.

Where excavation to the grade established in the field by the Engineer terminates in loose or solid rock, the Contractor may be required to extend the depth of excavation six (6) inches and backfill with select material compacted in an approved manner to a satisfactory density. Subject to the approval of the Engineer the select material backfill may be obtained from any point within the right-of-way where suitable backfill material is available.

c) PROVISIONS FOR DRAINAGE. If it is necessary in the prosecution of the work to interrupt the natural drainage of the surface, or the flow of artificial drains, the Contractor shall provide temporary drainage facilities that will prevent damage to public or private interests, and shall restore the original drains as soon as the work will permit. The Contractor shall be held liable for all damages which will result from neglect to provide for either natural or artificial drainage which his work may have interrupted.

d) EMBANKMENT. Embankments shall be constructed in accordance with the lines, grades and typical sections as shown on the plans or established by the Engineer.

Prior to construction of embankments the ground surface upon which embankments are to be constructed shall be scarified in furrows uniformly spaced so that at least fifty (50) percent of the surface will be broken to a depth of at least four (4) inches.

Embankments shall be constructed of suitable materials and shall be placed in successive horizontal layers of not more than eight

(8) inches in depth, loose measurement for the full width of the embankment and in such length as designated. Stumps, trees, rubbish, vegetation or other unsuitable materials shall not be placed in embankments. All construction traffic shall be uniformly distributed over the entire surface of each layer of the embankment.

Each layer of the embankment and the completed embankment shall be compacted to not less than 90% of the Standard Proctor Density. No successive layer shall be placed until the layer under construction has been completed to the satisfaction of the Engineer.

After a section of the embankment has been completed it shall be maintained to grade and cross-section by blading when and to the extent required.

Embankments placed over and adjacent to pipes, culverts and other structures shall be of suitable materials and shall be placed in successive horizontal layers of not more than eight (8) inches in depth, loose measurement, and each layer uniformly mixed, pulverized and thoroughly compacted to the satisfaction of the Engineer by the use of rakes, hand tamps, and/or other approved methods. Special care shall be taken to prevent any wedging action against the structure. This method of consolidation and compaction shall be used for such distances along embankment adjacent to structures as may be necessary and in other areas where blading and rolling would be impractical.

e) EXCESS EXCAVATION. Unstable street excavation and suitable street excavation in excess of that needed for construction shall be disposed of as directed by the Engineer. In general, suitable excess street excavation will be used in the construction of parkways, widening of embankments, flattening of slopes, etc., but if necessary to waste any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause injury to street improvements or to abutting property.

f) CONSTRUCTION METHODS. The subgrade shall be scarified to a depth of four (4) inches, disced, harrowed or otherwise processed to break up all clods and pulverized sufficiently to permit uniform dispersion of moisture. When the loosened soil has been pulverized, it shall be thoroughly and uniformly compacted with suitable equipment to at least ninety (90) percent of Standard Proctor Density. The compacted subgrade shall conform to the planned section for the bottom of the course or pavement and shall not vary more than one inch from the template cut to the cross-section of the road, nor more than one inch from a straightedge applied parallel to the centerline of the road. All unstable material shall be removed and replaced with acceptable material. Through areas where no subbase is required all rock larger than three (3) inches in greatest dimension shall be removed and replaced with acceptable material. Areas of the subgrade which are not accessible to rolling equipment shall be compacted to the required density with approved mechanical tampers.

For Portland Cement concrete pavement the top of subgrade shall be slightly above finished grade to permit final shaping and dressing with a subgrade planer or other approved methods.

Subgrade shall be completed at least two hundred (200) feet and not more than five thousand (5,000) feet in advance of the construction of the new course. The subgrade shall be maintained in the condition specified until material for the proposed construction is placed.

Tests of the subgrade in place shall be made immediately in advance of placing the subsequent course and shall not vary more than the tolerances heretofore specified and any deficiency shall be corrected before material is placed.

g) COMPACTION (DENSITY) TESTS. Before any base material or pavement is placed on the subgrade, compaction or density tests shall be made by an approved independent testing laboratory. The field density test results shall be not less than 90% of Standard Proctor Density. At least two (2) field density tests will be made on each block of prepared subgrade. Additional tests may be required at questionable areas.

The Contractor will be responsible to furnish all test results as required directly to the City's Engineer. The City will select the testing agency to be used, but payment for density tests will be made by the Contractor.

#### STANDARD CONSTRUCTION SPECIFICATIONS

##### 74-400-02. PORTLAND CEMENT CONCRETE PAVING.

a) GENERAL. This item shall consist of a wearing course of Portland Cement Concrete constructed in one (1) course on the prepared subgrade or other completed and accepted base course in accordance with these specifications and in conformity with the lines, grades, thickness and typical cross-section shown on the plans.

##### b) MATERIALS.

(1) WATER. Water shall be free from injurious amounts of alkali, vegetable matter and shall be reasonably clear.

(2) CEMENT. Cement shall be that of a standard brand Portland Cement Type 1 or Type 1A, meeting the requirements of standard specifications of the ASTM Designation C-150 or C-175.

(3) COARSE AGGREGATE. Stone or gravel for aggregate shall be clean, tough, durable, practically free from coatings of any character or other deleterious material. Aggregates shall have a Los Angeles Abrasion of not more than 40% and shall conform to the following gradations:

<u>Sieve Size</u>	<u>% Passing</u>
1½"	100
1"	90 - 100
½"	25 - 60
No. 4	0 - 5

(4) FINE AGGREGATE. Aggregates shall consist of a sand composed of clean, hard, durable, uncoated grains, free from conglomerate, soft, or flaky particles, salt, alkali, or loam, and shall conform to the following gradation:

<u>Sieve Size</u>	<u>% Passing</u>
3/8"	100
No. 4	95 - 100
No. 16	45 - 85
No. 50	5 - 30
No. 100	0 - 7

(5) REINFORCING STEEL. Deformed bars shall be of standard commercial style, meeting ASTM Standards A15 and A305 and shall be placed as shown on the plans or as directed by the City Engineer. Dowel bars shall be smooth round bars meeting above ASTM Standards.

(6) AIR ENTRAINMENT. Air entraining shall be used in an amount so as to produce an air content not to exceed 7% by volume. Air Entrainment Agent shall be of a standard brand approved type, or Air Entraining Cement.

(7) SAND CUSHION. Sand or sandy gravel shall be a well graded material with a plasticity index of not more than 8, and shall be approved by the City Engineer.

c) DESIGN MIX. Concrete shall be composed of the above materials, properly proportioned by weight of scales certified at intervals not to exceed a twelve month period by a certified scale tester. Cement content shall be six sacks per cubic yard and water shall not exceed six gallons per sack of cement. The consistency of the concrete shall be measured by ASTM test C-143 and the slump shall not exceed 3". Design shall be such as to provide 3500 psi concrete at 28 days.

74-400-03. CONSTRUCTION METHODS.

a) SAND CUSHION. Upon the properly prepared subbase, place the required thickness of sand cushion as shown on the plans and approved by the City Engineer. This material shall be spread and compacted at or slightly above optimum moisture to obtain a density acceptable to the City Engineer before proceeding further with construction.

The finished subgrade shall be maintained in a smooth and compacted condition until the concrete has been placed.

b) FORMS. Forms for concrete slabs shall be set to the lines and grades as shown on the approved plans within  $\frac{1}{4}$  inch plus or minus. They shall be of metal composition and shall be tight and straight enough when linked together tightly and properly pinned and/or braced will form a neat uniform grade able to withstand the pressures applied by the concrete or the impact of the finishing machine. Forms shall be oiled before placing concrete.

c) PLACING AND FINISHING CONCRETE. The prepared subgrade shall be wet down by sprinkling uniformly with water before placing of concrete begins. Only an amount of water that will be taken up immediately by the subgrade will be applied, care being taken that no pools of water shall be created. During warm dry weather, the contractor shall wet the subgrade thoroughly several hours before the placing of concrete begins, when required by the Engineer. The concrete shall be deposited on the subgrade in such a manner as to require as little rehandling as possible. The necessary spreading shall be done by means of shovels, not rakes. The concrete shall be vibrated or vigorously spaded while being placed alongside forms to prevent honeycombed surfaces. Any portion of a batch in which segregation might occur shall be thoroughly mixed with the main body of the batch during the process of spreading.

The operation of placing concrete shall be continuous; however, when work is unavoidably suspended for a period longer than thirty minutes after the depositing of concrete has ceased, a transverse joint shall be constructed and the slab finished to this joint.

Mixing and placing of concrete shall be stopped in time to allow finishing to be completed in daylight hours, unless special permission is granted by the Engineer.

No concrete shall be placed on soft, wet, or frozen subgrade. In general, no concrete shall be placed when the air temperature is below 35° F. and falling. However, the Engineer may require that no concrete be placed when in his opinion the concrete might become damaged from subsequent low temperatures.

After placing, the concrete shall be leveled and immediately struck off by means of an approved transverse finishing machine or by approved hand methods. The template shall be shaped to the desired cross-section and have sufficient strength to retain its shape under all working conditions.

d) LONGITUDINAL FLOATING. After the concrete has been struck off and consolidated, it shall be further smoothed and consolidated by means of a longitudinal float.

The longitudinal float may either be a mechanical float meeting the approval of the Engineer or a manually operated float. The

hand operated float shall be a rigid straight-edge float not less than twelve (12) feet nor more than eighteen (18) feet in length with a troweling or smoothing surface not less than eight (8) inches nor more than twelve (12) inches in width, and shall be worked from bridges spanning the pavement. The float shall be used with its length parallel to the centerline of the pavement and shall be operated with a combined longitudinal and transverse motion, planing off the high places and filling in the depressions. Floats shall overlap the area previously floated by about one-half ( $\frac{1}{2}$ ) the length of the float.

The mechanical float shall be so adjusted and so operated that the screed will have a small quantity of concrete in front of it at all times as depressions will not be filled unless concrete is made available for this purpose. The screed shall not be raised or lowered solely for the purpose of maintaining the proper amount of concrete in front of the screed.

After floating, whether the hand method or machine method is used, any excess water and laitance shall be removed from the surface of the pavement transversely by means of a long-handled float having a blade not less than five (5) feet in length and six (6) inches in width. Successive transverse drags of either tool shall be lapped one-half ( $\frac{1}{2}$ ) the length of the blade. The use of the long-handled float shall be confined to a minimum. It may be used behind the longitudinal float to correct surface unevenness not taken care of by the longitudinal float, but it shall not be used to float the entire surface of the pavement in lieu of, or supplementing, the use of the longitudinal float. When strike-off and consolidation are done by the hand method, and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long handled float. Care shall be taken not to work the crown out of the pavement during the operation.

After the longitudinal floating has been completed and the excess water removed, but while the concrete is still plastic, the slab surface shall be tested for trueness with a straight-edge. For this purpose the Contractor shall furnish and use an accurate ten (10) foot metal straight-edge swung from handles three (3) feet longer than one-half ( $\frac{1}{2}$ ) the width of the slab. The straight-edge shall be held in successive positions parallel to the road centerline in contact with the surface and the whole area gone over from one side of the slab to the other as necessary. Advance along the road shall be in successive stages of not more than one-half ( $\frac{1}{2}$ ) the length of the straight-edge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas shall be cut down and refinished. Straight-edge testing and surface correction shall continue until the entire surface appears to conform to the required grade and contour.

When straight-edging is completed and water sheen has practically disappeared and just before the concrete becomes nonplastic, the surface shall be belted with a suitable belt of two (2) ply canvas, or other material acceptable to the Engineer, approximately six (6) inches wide and two (2) feet longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform manipulation. The belt shall be operated with short strokes transverse to the road centerline and with a rapid advance parallel to the road centerline.

Care shall be taken not to work the crown out of the pavement slab, nor to permit the edges of the belt to dig into the surface of the concrete. The belt shall be cleaned after each day's run.

Before the concrete obtains its initial set the surface shall receive a final belting in order to obtain a uniform surface of gritty texture. This belting shall be short, rapid, transverse strokes having a sweeping longitudinal motion. Badly worn belts must be discarded and new ones supplied.

Either machine belting or hand belting will be permitted for both belting operations.

Between the first and second beltings, the hand-formed or machine-formed contraction joints shall be finished and the concrete over the expansion joints shall be carefully removed. The edges of the concrete at joints shall be finished with an edger to the radius shown on the plans. The belt during final belting shall be raised over the expansion joints and any contraction joints formed while the concrete is green.

Edges of pavement slab or lip curb and all open joints and construction joints shall be edged with an edger having a one-eighth (1/8) inch radius.

e) LOCATION OF JOINTS. The location of joints shall be shown on the plans, and or as provided in these specifications, or as directed by the Engineer. Three-quarter inch transverse expansion joints shall be placed at intervals not exceeding 500 feet and around all intersections. Transverse joints shall be sawed 1½ inches deep. All sawed joints shall be sawed as soon as concrete takes initial set before shrinkage permits transverse cracking outside of sawed joints. All joints shall be sealed to within ¼ inch of surface with an approved joint filler material.

f) CURING CONCRETE. Immediately after finishing operations have been completed, the entire surface of the newly laid concrete shall be covered with a membrane type curing compound. The membrane must be pigmented so that it can be readily distinguished on the surface where it has been placed.

Whenever the atmospheric temperature is 100°F. or more, the Engineer shall have the right to require an additional coat of curing compound at the rate of approximately 1 gallon per 30 square yards of surface.

g) PULLING FORMS. Forms shall be stripped within 48 hours in every case or as soon as concrete has attained sufficient strength that it will not be damaged by the operation. All honeycombs shall be patched immediately after forms are removed, with a cement mortar.

h) BACKFILLING. Backfilling shall be accomplished as soon as possible after forms are removed. Suitable material shall be used and properly compacted until it becomes firm and solid.

i) NOTIFICATION. The City's Engineer shall be notified ahead of construction so that ample inspection can be provided for.

j) NON-CONFORMANCE. Non-conformance of any of the above specification will be cause for suspension of work in progress by the City Engineer until such time as is necessary to correct the deficiency. Deficient thickness of more than  $\frac{1}{4}$  inch shall be removed and replaced at the discretion of the City Engineer.

74-400-04. TESTING.

a) Three (3) test cylinders shall be taken at intervals not to exceed five hundred (500) lineal feet. At least three (3) test cylinders shall be taken covering each days pour.

b) After the street paving is complete, core samples shall be taken on each 600 sq. yds. of paving. Additional cores may be required if a deficiency is observed to determine the extent of deficient paving.

c) The contractor will be responsible for all samples and shall furnish all test results as required directly to the City Engineer. Tests shall be made by an approved testing agency and payment for all tests and field inspection pertaining to this project shall be made by the Contractor.

74-400-05. MAINTENANCE BOND.

The Contractor shall provide a good and sufficient Maintenance Bond in an amount equal to one hundred percent (100%) of the cost of completed paving, guaranteeing the maintenance against any failure due to defective materials or workmanship of such improvement for a period of one (1) year from and after the time of its completion and acceptance by the City of Duncan. All bonds shall be acceptable to the City and shall be executed by surety companies licensed to do business in the State of Oklahoma.

74-400-06. STORM SEWER INLET.

a) DESCRIPTION. This item shall consist of the construction of Storm Sewer Inlets in conformity with the plans and specifications and as directed by the Engineer.

b) MATERIALS. All materials shall conform to the requirements of Oklahoma Department of Transportation Standard Specifications, latest Edition, in Division VII, Material Details, of said specifications.

c) CONSTRUCTION METHODS. Construction shall be in accordance with Oklahoma Department of Transportation Standard Specifications, latest Edition, Section 611.

d) METHOD OF MEASUREMENT. Storm Sewer Inlets shall be measured for payment as "Storm Sewer Inlet, Design SSI - 2", complete in place.

e) BASIS OF PAYMENT. The quantities measured as provided above shall be paid for at the unit price bid for "Storm Sewer Inlet, SSI-2" and such payment shall be full compensation for all materials, falsework, labor, equipment, excavation and backfill, and incidentals necessary to complete the work as specified.

74-400-07. CORRUGATED GALVANIZED METAL PIPE ARCH.

a) DESCRIPTION. This item covers the furnishing and placing of Corrugated Galvanized Metal Pipe Arch, at the locations shown on the plans or as directed by the Engineer.

b) MATERIALS. All materials shall conform to the requirements of Oklahoma Department of Transportation Standard Specifications, latest Edition, in Division VII, Material Details, of said specifications.

c) CONSTRUCTION METHODS. Construction shall be in accordance with Oklahoma Department of Transportation Standard Specifications, latest Edition, Section 513.

d) METHOD OF MEASUREMENT. Corrugated Galvanized Metal Pipe Arch will be measured by the linear foot and the quantities to be paid for under this item will be the number of linear feet in place completed and accepted.

e) BASIS OF PAYMENT. Corrugated Galvanized Metal Pipe Arch, measured as provided above, shall be paid for at the contract unit price bid per linear foot for "Corrugated Galvanized Metal Pipe-Arch", which price shall be full compensation for furnishing all materials, labor, equipment, and incidentals necessary to complete the work.

74-400-08. CONCRETE CURB AND GUTTER.

a) DESCRIPTION: This work shall consist of the construction of concrete combined curb and gutter, or concrete header curbing in accordance with these specifications and in reasonably close conformity with the lines, grades and dimensions shown on the plans or established by the Engineer.

b) MATERIALS. Concrete for combined curb and gutter or concrete header curbing shall be of the composition and consistency as required under Section 74-400-02(b), Portland Cement Concrete Pavement.

All materials will be subject to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials in the work.

c) CONSTRUCTION METHODS. (a) Excavation. Excavation shall be made to the required depth, and the base upon which the curb is to be set shall be compacted to a firm, even surface. All soft and unsuitable material shall be removed and replaced with suitable material which shall be thoroughly compacted.

(1) FORMS. Forms shall be of wood, metal or other suitable material, straight, free from warp and of such construction that there will be no interference to the inspection of grade or alignment. All forms shall extend for the entire depth of the curb and shall be braced and secured sufficiently so that no deflection from alignment or grade will occur during the placing of the concrete.

Forms shall be sufficiently tight as to prevent leakage of mortar. Forms shall be clean and oiled or wetted before placing concrete.

(2) PLACING CONCRETE. Checking forms, placing, vibrating, spading and tamping shall be in accordance with Section 74-400-03(c).

Central mixing or transit mixing will be permitted.

(3) SURFACE FINISH. Surface finish shall be in accordance with Section 74-400-03(c).

(4) JOINTS. All joints in curb or combined curb and gutter shall be perpendicular to the subgrade, at right angles to the longitudinal axis of the curb or combined curb and gutter, and shall entirely separate the adjacent sections of concrete.

Expansion joints shall be premoulded expansion joint filler and shall be of the thickness and placed at the locations shown on the plans or as directed by the Engineer. Where there are transverse expansion or contraction joints in the abutting pavement, expansion joints shall in general be placed in the curb, gutter, or combined curb and gutter opposite the joints in the pavement.

(5) CURB OPENINGS. Where curb is to be omitted for driveways, or other cause, either all or only the top portion of the separate curb may be omitted as shown on the plans or as directed. In general, only the curb will be left off of combined curb and gutter. Where the bottom portion of separate curb or the gutter of combined curb and gutter is left in place, the concrete shall be constructed slightly higher at the back of the curb line than at the front as shown on the plans or as directed. Such curb shall be considered as regular curb.

(6) CURING. Concrete curbs or combined curb and gutter shall be cured in the same manner as required for paving slab under Section 74-400-03(e).

(7) CURB MACHINE. With the approval of the Engineer, the curb may be constructed by the use of a curb forming machine.

When satisfactory results are not being obtained, the Contractor shall resort to form type construction. Proportions of fine and coarse aggregate shall be modified as necessary to fit specific aggregates and job conditions provided that the mix shall contain not less than six (6) sacks of cement per cubic yard. An air entrainment agent shall produce an air content of approximately 5½ percent air within plus or minus two (2) percent.

When the extruded method is used to construct combined curb and gutter, the extrusion machine shall be operated on rails or forms set at uniform depth below the predetermined finished top of curb grade.

Concrete shall be uniformly fed to the machine and shall be of such consistency that after extrusion the concrete will maintain the shape of the section without support. The finished curb or gutter shall present a well compacted mass with a surface free from voids and honeycomb and reasonably true to established shape, line and grade. Any additional surface finishing required shall be performed immediately after extrusion.

Expansion and weakened joints shall be constructed at the same locations as required when form construction is being used. Weakened joints, spaced at 10-foot intervals, shall be made by cutting the concrete with a trowel or by other acceptable methods. The manner of construction of all joints shall meet the approval of the Engineer and shall, after edging, present a workmanlike finish.

(8) BACKFILL. Backfill shall be in accordance with Section 74-400-03(g).

74-400-09. TESTING.

a) Three (3) test cylinders shall be taken at intervals not to exceed 800 lin. ft. of curb and gutter.

b) The Contractor will be responsible for all samples and shall furnish all test results as required directly to the City Engineer. Tests shall be made by an approved testing agency and payment for all tests shall be made by the Contractor.