SECTION 02511 – PORTLAND CEMENT CONCRETE PAVEMENT

PART 1: GENERAL

1.01 SCOPE

A. Perform all work required to complete, as indicated by the Plans and Specifications, and furnish all supplementary items necessary for the proper installation of Portland Cement Concrete Pavement.

B. This item shall consist of furnishing and placing Portland Cement Concrete Pavement on the prepared subgrade, in conformity with the Plans, as herein specified. All reinforced concrete pavement excluding sidewalks and turned down curb, shall conform to the provisions and requirements of these Specifications.

C. Related information or work specified elsewhere in the Project Manuals includes, but is not limited to, the following:

1. General and Supplementary Conditions of the Contract
2. Division 1 – As applicable
3. Section 01410 – Testing Laboratory Service
4. Section 02100 – Site Preparation
5. Section 02200 – Earthwork
6. Section 02230 – Aggregate Base
7. Section 02525 – Concrete Curbs

1.02 REQUIREMENTS, CODES

A. The following Specifications are minimum requirements and shall govern, except that all local, county, state, and/or federal codes and ordinances shall govern when their requirements exceed those specified herein.

B. Comply with all requirements of the North Central Texas Council of Governments Standard Specifications for Public Works Construction, latest edition.

1.03 ACCEPTANCE OF PAVEMENT THICKNESS

A. Determine pavement thickness by measuring cores taken at points as directed. At least one core will be taken for each 500 square yards of pavement. The Owner's representative will perform the initial coring.

B. If a deficient thickness is found in an initial core, additional cores must be taken along the length of pavement in each direction from the identified point of deficient thickness. Take the additional cores at 10-foot intervals until cores are obtained which measure the designated thickness. The cost of additional cores to determine area of deficient thickness will be paid for by the Contractor.

C. Pavement meeting or exceeding designated thickness will be accepted provided design strengths as specified on the Plans have also been achieved or exceeded.

D. Pavement within 1/4-inch of the designated thickness will be considered of satisfactory thickness. Pavement which is deficient by more than 1/4-inch of the designated thickness will be considered as unsatisfactory thickness. The area of unsatisfactory thickness will be determined by the same method as used to determine the area of deficient thickness. The Contractor shall remove the pavement and replace it with pavement of the designated thickness for which payment will be made as specified. No reimbursement will be granted for removing pavement of unsatisfactory thickness.

1.04 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without prior written approval. The class of aggregate being used can be changed before or during the job with proper notice. The new class must meet specification.

B. Segregated aggregate will be rejected. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

C. Aggregates mixed with dirt, weeds or foreign matter will be rejected. Do not dump or store aggregate on the prepared subgrade.

1.05 SUBMITTALS

A. Submit items listed in Section 01410.

1.06 COORDINATION

A. Coordinate with all other trades to allow installation of embedded items, sleeves, conduit, etc., prior to placing concrete.

1.07 QUALITY ASSURANCE

A. See Section 01410.

PART 2: PRODUCTS

2.01 MATERIALS

A. Portland Cement. Sample and test cement to verify compliance with standards of ASTM C-150, Type I unless otherwise approved by Engineer. Bulk cement which meets referenced standards may be used if the method of handling is approved by the Engineer. When using bulk cement, provide satisfactory weighing devices.

B. Water. Furnish clean, drinkable water free from injurious amounts of oils, acids, alkalis or other deleterious substances, in accordance with ACI and ASTM requirements.

C. Coarse Aggregate. Provide crushed stone or gravel which is clean, hard, durable and well graded within specified limits, complying with ASTM C-33. When tested by standard laboratory methods, coarse aggregate must conform to the following requirements:

The maximum percentage by weight of deleterious substances must not exceed the following values.

Constituents	Percent by Weight
Removed decantation	1.0
Shale	0.25
Clay Lumps	0.25
Soft Fragments	3.0
Other local deleterious substances, such as friable pieces	3.0
The sum of the percentages of above constituents shall not exceed	5.0

Furnish coarse aggregate worn no more than 45 percent when tested according to AASHTO T96.

Conform to the following grading requirements for aggregate tested on a standard square-opening sieve.

Sieve	Percent Retained
2-1/2 inches	0
1-3/4 inches	0 to 20
3/4 inch	25 to 65
No. 4	95 to 100

D. Fine Aggregate: Provide washed sand having clean, hard durable grains, well graded from coarse to fine. The sand must be free from soft or flaky particles or other injurious matter. When tested by standard laboratory methods, fine aggregate must conform to the following requirements:

Conform to the following grade requirements for aggregates tested on standard sieve.

Screen or Sieve	Percent Retained by Weight
3/8 inch screen	0
1/4 inch screen	0 to 5
20 mesh sieve	15 to 50
100 mesh sieve	85 to 100

Weight removed by elutriation test must be not more than two (2) percent.

When subjected to color test for organic impurities, fine aggregate must not show color darker than standard color.

E. Reinforcing Steel. Provide new billet steel manufactured by the open hearth process and conforming to ASTM A-615, Grade 60. Store steel to protect it from mechanical injury and rust. At the time of placement, steel should be free from dirt, scale, rust, paint, oil or other injurious materials.

Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be re-bent.

Wire fabric must be of gauge and facing shown and must meet ASTM A-82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds must have sufficient strength not to be broken during handling or placing. Welding and fabrication of fabric sheets must conform to standard ASTM A-185.

Furnish the manufacturers certificate giving property of steel. Provide specimens for testing, when required.

F. Air Entraining Agent. Furnish an air entraining agent which meets standard of ASTM C-260. Use MB-VR by Master Builders Company, Air-in by Hunt Process Corporation-Southern, or an approved equal.

G. Expansion Joint Material. Furnish filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heat cypress weighing no more than forty (40) pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heat redwood weighing no more than thirty (30) pounds per cubic foot, after being oven dried to constant weight.

H. Joint Sealing Compound. Furnish hot-poured elastomeric polymer exceeding Federal Specifications SS-S-164.

I. Load Transmission Devices. Provide smooth steel bar dowel, as shown. Steel bars must conform to standards of ASTM A-615, Grade 60.

J. Metal Supports for Reinforcing Steel and Joint Assembly. Employ metal of approved shape and size. Space supports as directed.

K. Liquid Membrane Forming Compound for Curing Concrete. Provide Type II white pigmented compound conforming to standards of ASTM C-309.

L. Refer to ACI Standard 305 for hot weather concreting when outside temperature is 75º F and rising.

2.02 PROPORTIONING

A. Responsibility. Proportioning of the concrete mix is the responsibility of the Contractor. Design the concrete mixture and furnish a statement giving the proportion of materials in the mix. Submit commercial laboratory report showing that proportions and materials selected will produce laboratory mixed concrete of the specified quality, having strength 10 percent higher than that specified. Submit mix design to the Owner for their approval prior to commencing concrete pouring. Testing of design mixes is the Contractor's responsibility, per Section 01410.

B. Concrete Mix. Provide a concrete mix that is uniform and workable. Design the mix to produce concrete which will have a compressive strength as specified on the Plans and typical sections. Settlement of concrete must be at least 2-1/2 inches, but no more than four (4) inches, when gauged by a standard slump test.

C. Concrete mix must contain at least 5.0 sacks of cement per cubic yard, with not more than 6.5 gallons of water, net per sack of cement. The net amount of water is the amount of add at the mixer, plus prewater in the aggregate, minus absorption the aggregate displays in minutes. No water allowance will be made for evaporation after batching. Coarse dry aggregate will not exceed 85 percent of the loose volume of concrete.

D. Add the air entraining agent to the concrete to produce the effect that could be obtained by use of air-entrained Portland cement, as specified in ASTM C-150. Use the amount needed to entrain six (6) percent ñ1 percent of the total volume of concrete. Add the agent to the batch in a solution of the mixing water. Batch this solution by means of a mechanical batcher capable of accurate measurement. Ensure a uniform distribution throughout the batch during the specified mixing period.

E. Retardant is optional when the temperature exceeds 85ø F, and must be approved by the Engineer. Proportion as recommended by the manufacturer. Use the same brand as used for the air entraining agent. Add and batch the material using the same methods as used for the air entraining agent.

2.03 MIXING EQUIPMENT

A. Mixing equipment must be in first class working condition and must be inspected and approved by the Owner before paving operations will be permitted.

B. Weigh materials separately and accurately using standard scales attached to a standard batching plan approved by the Owner. Consider a sack of cement weighing 94 pounds to be one (1) cubic foot. Employ beam type or springless dial type scales. Equip the beam type with a springless dial indicator showing at least 100 pounds over or under the required weight. Use graduated scales or dial indicator showing increments of five (5) pounds or less. Use scales accurate within four (4) pounds per 1,000 pounds per net load in the hopper.

C. A capacity of not less than a 21-E mixer, as rated by Mixer Manufacturers Bureau of Associated General Contractors, is required. Provide a speed regulator to hold a mixer to the normal speed of revolution. Equip the mixer with an automatic timer and lock for the discharging device to prevent discharge until all materials have been mixed together for the minimum time required. The timer and lock must operate independently of the drum. Also provide a bell to indicate completion of a mixing time. The bell must be plainly audible to a distance of 50 feet from the mixer.

Equip the mixer with an accurate device to measure water within one (1) percent of the total amount required. Construct the measuring drum with an opening to atmospheric pressure when the measured amount of water is inside. Place and construct the drum so that a single batch of water can be discharged into a calibrated tank or a weighing device attached to the mixer, without seriously delaying paving operations. Check the operation of this water measuring device daily.

D. Batch trucks, for the transportation of measured materials from the batching plant to the mixer, must be covered right to prevent excessive evaporation or any loss of materials.

2.04 MIXING

A. Central batching and transit mixing will be permitted. A central mixing plant will be allowed upon approval of mixing and handling methods.

B. Mix concrete in a batch-mixer as specified only in such quantities as are required for immediate use. Thoroughly mix aggregate and cement for a period of not less than 50 seconds, computed from the time the last aggregate disappears into the drum until the concrete begins to appear in the discharge chute. Lock the mixer discharge with an automatic timing device until the specified time has elapsed. Introduce water into the drum during the first 15 seconds of mixing. Discharge the entire contents of the drum before the materials are placed for a succeeding batch. Retempering or remixing will not be permitted.

C. For transit mixed concrete use a water-type truck mixer. Mix each batch for 100 revolutions at the mixer manufacturer's mixing speed. Perform additional mixing or agitation at the speed specified for agitation.

D. Stamp the time of loading the transit-mix truck on the delivery ticket before the truck leaves the plant. Equip truck mixers with water tank and measuring devices which permit positive measurement of mixing water. When aggregate contains more than six (6) percent water, place the concrete within 1/2 hour after the introduction of water. When aggregate contains from three (3) percent to six (6) percent water, place the concrete within 1 hour after the introduction of cement. Transmit-mix concrete must conform to other applicable requirements of this section.

PART 3: EXECUTION

3.01 WEATHER CONDITIONS

A. Place concrete only when the air temperature is above 35ø F and rising. The Contractor is responsible for the quality and strength of concrete placed under any weather conditions.

3.02 EQUIPMENT

Equipment for preparing subgrade and for finishing and compacting must be in good working order and be approved before commencing work.

A. Subgrade Planer and Template. Use a subgrade planer with adjustable cutting blades to trim the subgrade to the exact sections shown on the Drawing. Select a planer with wheels which ride on the form. The planer frame must have sufficient weight so that it will remain on the form at all times, and have such strength and rigidity that, under tests made by changing the support from wheels to cutters, the planer will not develop deflection of more than 1/8 inch. Tractors used to pull the planer must not produce ruts or indentations in the subgrade. When the slip form method of paving is used, operate the subgrade planer on a prepared track grade or have it controlled by an electronic sensor system operated from a string line that establishes the horizontal alignment and elevation of the subbase.

Provide a template for checking the contour of the subgrade. The template must be long enough to rest upon side forms and have such strength and rigidity that under tests made by changing the support to the center, the template will not show deflection of more than 1/8. Fit the template with accurately adjustable rods to gauge the cross sections of the slab bottom when the template is resting on the side forms.

B. Machine Finisher. Provide a power-drive, transverse finishing machine designed and operated to strikeoff and consolidate the concrete. Select a machine with two screeds accurately adjusted to the crown of the pavement and with a frame equipped to ride on the form. Use a finishing machine with rubber tires if it operates on concrete pavement.

C. Hand Finishing. Provide a mechanical strike and tamping template the width of the pavement to be finished. Shape the template to the pavement section. Also provide floats of approved design. Provide two bridges for finishing expansion and dummy joints and necessary edging and finishing tools to complete the pavement slab.

D. Burlap Drag for Finishing Slab. Furnish four plies of 10-ounce burlap material fastened to a bridge to form a continuous strip of burlap the full width of the pavement. The three (3) foot width of burlap material must be in contact with the pavement surface. Keep the burlap drags clean and free of encrusted mortar.

E. Vibrators. Furnish mechanically operated synchronized vibrators mounted on ramping bar which rides on the forms. Also employ approved hand-manipulated mechanical vibrators. Furnish vibrators with a frequency of vibration providing the maximum consolidation of concrete without segregation.

F. Traveling Form Paver. A traveling form paver of approved design may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. If a traveling form paver is used, all requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship must be met in full. If a traveling form paver proves inadequate, in providing a pavement which meets the drawings and specification in all respects, its use will be immediately discontinued when so ordered by the conventional methods will be used. Equip the traveling paver with a longitudinal transangular finishing float adjustable to crown and grade. The float must be long enough to extend across the pavement practically to the side forms or the edge of the slab.

Prior to beginning paving operations, ensure that a continuous deposit of concrete can be made at the paver to minimize starting and stopping. Pave by conventional means those locations inaccessible to a traveling paver, or having horizontal or vertical curvature that a traveling paver cannot negotiate.

Do not place reinforcing steel mechanically. Where the Plans require tie bars to be installed for adjacent paving, securely tie and support the bars to prevent displacement. Alternatively, tie bars may be installed with an approved mechanical bar insert mounted on a traveling-form paver. Replace any pavement in which tie bars assume a final position other than that shown on the Drawing.

3.03 SUBGRADE

A. Properly prepare, shape and compact each section of subgrade before placing forms, steel or concrete, per requirements of Section 02230. After forms have been set to proper grade and alignment, use a subgrade planer to shape the subgrade to its final cross section. Check the contour of the subgrade with the template. No concrete shall be placed until the subgrade passes compaction testing per Sections 01410 and 02230.

3.04 FORMS

A. Side Forms. Use metal forms of approved shape and section. A form as deep as the pavement edge thickness is preferred. Forms with depth up to one (1) inch greater or less than pavement thickness may be used. Forms with less depth than pavement thickness will be brought to required depth by securely attaching wooden planks of approved section and size to the bottom of the form. Use a form section at least 10 feet in length, and staked in position with at least three pins. Forms must have adequate strength to withstand machine loads without visible springing or settlement. Use forms free from warps, bends, and kinks and sufficiently true to provide a straight edge and verify that it conforms with the requirements for the surface of completed pavement. Use flexible or curved forms of wood or metal to set proper radius on curves of 100 feet radius or less.

B. Form Setting. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Remove subgrade that will not support the loaded form. Replace and compact subgrade to required density. Accurately set forms to required grade and alignment and, during the entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 foot of length. Do not remove forms for at least 24 hours after the completion of finishing operations. Provide a supply of forms that will be adequate to complete with this requirement and for orderly and continuous placing of concrete. Set the forms and check the grade for at least 130 feet ahead of the mixer.

Adjacent slabs may be used instead of the forms, provided that the concrete is well protected from possible damage by finishing equipment. These adjacent slabs must not be used for forms until the concrete has aged at least seven (7) days. For short radius curves, forms less than 10 feet in length of curved forms may be used. For curb returns at street intersections and driveways, wood forms of good grade and quality may be used. Do not use any metal which, in the opinion of the Engineer, is unsuitable for forms.

3.05 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Accurately place reinforcing steel and joint assemblies and position them securely in accord with details shown. Wire reinforcing bars securely together at intersections and splices. Bars and coatings must be free of rust, dirt, or other foreign matter when the concrete is installed.

B. Place pavement joint assemblies at required locations and elevation and rigidly secure all parts in required positions. Install dowel bars accurately in joint assemblies as shown, each parallel to the pavement surface and to the center line of the pavement and rigidly secure in the required position to prevent displacement during placing and finishing of concrete. Accurately cut header boards, joint filler and other material used for forming joints to receive each dowel bar.

C. Place all reinforcing steel and secure to chairs.

3.06 PLACING

A. Batches not placed as specified within 30 minutes after water or cement has been added will be rejected. Fine aggregate containing more than six (6) percent moisture and coarse aggregate containing more than three (3) percent moisture will likewise be rejected.

B. Deposit concrete rapidly and continuously on subgrade or subbase in successive batches. Distribute concrete to the required depth and for entire width of the pour by shoveling or by other approved methods.

C. Do not use rakes in handling concrete. At the end of the day or in case of unavoidable interruption of more than 30 minutes, place a transverse construction joint at the point of stopping work, provided that the section on which work has been suspended is not less than 10 feet from the preceding joint. Sections less than 10 feet long must be removed and replaced.

D. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in the edge of the finished pavement will be cause for rejection.

3.07 COMPACTING

A. Consolidate the concrete using an approved mechanical vibratory unit designed to vibrate concrete internally. Extend a vibratory unit across the pavement, not quite touching the side forms. Equip the unit with synchronized vibrators.

B. Space individual vibrators at close enough intervals to vibrate and consolidate the entire width of the pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

C. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.08 FINISHING

A. Finish concrete pavement by power-driven transverse finishing machines or by hand finishing methods.

B. Use the transverse finishing machine to make at least two trips over each area. Make the last trip over a given area a continuous run of not less than 40 feet. After transverse screening, use a hand-operated longitudinal float to test and level the surface to the required grade.

C. Hand finish with a mechanical strike and tamping template as wide as the pavement to be finished. Shape the template to the pavement section. Move the strike template forward in the direction of the work, maintaining a slight excess of material in front of the cutting edge. Make at least two trips over each area. Screen the pavement surface to the required section. Work the screen with a combined transverse and longitudinal motion in the direction work is progressing. Maintain the screen in contact with the forms. Use a longitudinal float to level the surface.

D. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with a strike off screen. Move the strike-off screen forward with combined transverse & longitudinal motion in direction work is progressing, maintaining the screen in contact with the forms, and maintaining a slight excess of materials in front of the cutting edge. Tamp the concrete with a tamping template. Use a longitudinal float to level the surface.

E. After completion of the straight edge operations, make the first pass of a burlap drag as soon as construction operations permit and before the water sheen has disappeared form the surface. Follow this by as many passes as required to produce the desired texture depth. Permit no unnecessary delays between passes. Keep the drag wet, clean and free from encrusted mortar during use.

3.09 SURFACE TESTS

A. Test the entire surface before the initial set and correct irregularities or undulations. Bring surface within requirements of the following test and then finish. Place an approved 10-foot straight edge parallel to the center of the roadway to bridge any depressions and touch all high spots. Do not permit ordinates measured from the face of the straight edge to the surface of the pavement to exceed 1/16 inch per foot from the nearest point of contact. In no case permit the maximum ordinate to a 10-foot straight edge to exceed 1/8 inch.

3.10 JOINTS

A. Placement. Place joints of the types shown on the Plans.

B. Construction Joints. Place a transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Use longitudinal construction joints at interior edges of pavement lanes where required.

Work the concrete well against the bulkhead. The keyway on the longitudinal construction joint may be omitted when a traveling form paver is used, and when No. 5 deformed tie bars, 30 inches long and spaced 18 inches on centers, are used.

C. Expansion Joints. Place expansion joints at radius points of curb returns for cross street intersections, or as shown. Use no boards shorter than six (6) feet. When pavement is 24 feet or narrower, use not more than two lengths of board. Secure places by means of a straight joint. Shape board filler accurately to the cross section of the concrete slab. Use premolded devices of the type and size shown. Use a joint sealing compound as required.

D. Sawed Joints. Saw joints to the details shown on the plans. Vary the time of sawing, depending on existing and anticipated weather conditions, to prevent uncontrolled cracking of the pavement. Saw joints as soon as the concrete has hardened sufficiently to permit cutting the concrete without excessive chipping, spalling or tearing. Saw joints at the required spacing consecutively in the sequence of the concrete placement, unless otherwise approved. Use a chalk liner or other suitable guide to mark the alignment of the joint, and maintain the saw cut straight from edge to edge of pavement. Wet the surface of pavement cured with membrane-curing compound with water in the region of the saw cut prior to sawing in order to protect the curing membrane from abrasion. Workmen shall wear clean rubber-soled footwear. Limit the number of persons walking on the pavement to those actually performing the sawing operation. Immediately after sawing each joint, thoroughly flush the saw cut and adjacent concrete surface with water until all waste from sawing is removed from the joint. Respray membrane cured surfaces damaged during the sawing operations as soon as the surface becomes dry. The sawing equipment shall be adequate in number of units and power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started.

3.11 CURING

Cure all concrete pavement by protecting it against loss of moisture for a period of not less than 72 hours from the beginning of curing operations. Immediately after finishing operations have been completed, cover and cure the entire surface of the newly laid concrete to meet the requirements specified for whichever one of the following methods the Contractor may elect. In all cases in which curing requires the use of water, the curing shall have prior to all water supply or supplies. Failure to provide sufficient cover material of the type the Contractor elects to use, failure to maintain saturation in wet curing methods, lack of water to adequately take care of both curing and other requirements, or other failures to comply with curing requirements shall be cause for immediate suspension of concreting operations. Remove covering material used in curing as necessary to comply with the requirements for surface test. Maintain concrete surface wet with a water spray if required, and replace the covering material immediately on completion of testing and any required surface correction.

A. Cotton Mat Method. After the concrete has been finished as specified above, and the concrete has taken its initial set, completely cover the surface with cotton mats and thoroughly saturate with water before application in such manner that they will contact the surface of the concrete equally at all points. Immediately upon the removal of side forms, establish drainage as specified or directed. Completely cover the edges of the concrete, if exposed, with either saturated cotton mats or saturated earth.

Maintain the cotton mats on the concrete for not less than the specified curing period, and keep saturated so when lightly compressed, water will drip freely from them. Keep earth banked against edges of concrete or cotton mats covering edges saturated. The cotton mats used for curing shall meet the following requirements:

1. Each mat shall have a finished width of approximately five feet-six inches (5'6"), and after shrinkage shall be at least six (6) inches longer than the width of the concrete to be cured.

2. The mats shall be composed of a single layer of cotton filler, completely enclosed in a corner of cotton cloth. The cotton filler shall be of low grade cotton, cotton liners or such cotton waste as comber noils or cord flat strips. The mats shall contain not less than 3/4 pound of cotton filler per square yard of mat, uniformly distributed. The cotton cloth used for covering material shall be Osonburg, weighing not less than 6-3/10 ounces per square yard.

3. All mats shall be stitched longitudinally with continuous parallel rows of stitching at intervals of not more than four (4) inches, or shall be tufted both transversely and longitudinally at intervals of not more than three (3) inches. The sewing or tufting shall not be done so tightly that the mat will not contact the surface of the concrete at all points when saturated with water.

4. To insure the complete covering of the concrete where the mats fit together, provide flap extending all along one side of each mat. This flap shall be composed of two thicknesses of the cover material and shall be at least six (6) inches in width.

B. Waterproofed Paper Method. After the concrete base or pavement has been finished as specified above and the concrete has taken its initial set, wet with water applied in the form of a fine spray and cover with waterproofed paper so placed and weighted as to cause it to remain in intimate contact with the concrete surface. Waterproofed paper used for the curing of concrete shall be of a type and quality approved by the Engineer. It shall be sufficiently strong and tough to permit its use under the conditions existing on street paving work without being torn or otherwise rendered unfit for the purpose during the curing period. Maintain the paper covering in place continuously for not less than the specified curing period.

The waterproofed paper shall be prepared to form blankets of sufficient width to cover the entire surface and both edges of the concrete to be cured. Such blankets occasioned by joining paper sheets shall lap not less than five (5) inches and shall be securely sealed with asphalt cement having a melting point of approximately 180ø F. Place blankets to secure an overall lap of at least 12 inches and securely weight this lap to form a closed joint.

Adequately weight the waterproofed paper blankets to prevent displacement or billowing due to wind, and secure the paper folded down over the side of the concrete by a continuous bank of earth. Plowing of this window into place will not be permitted.

Immediately repair all tears or holes appearing in the paper during the curing period by cementing patches over such defects. It shall be the Contractor's responsibility to prevent damage to the paper blankets which affect their serviceability and effectiveness as a concrete curing method. Blankets may be rejected at any time when they do not provide an airtight covering. Paper blankets rejected on account of pin holes or minor tears may be continued in service by folding the blanket over lengthwise, first thoroughly spraying one-half of the blanket with the asphalt cement used for seams. The two thicknesses shall be firmly pressed together and well cemented; all blankets shall be firmly pressed together and well cemented; all blankets shall be of a width sufficient to cover the base surface of both edges. Doubled blankets may be rejected for the same causes as provided for single blankets. Immediately mark all paper blankets condemned for identification and then destroy or store entirely separate from approved blankets.

No walking on the paper shall be permitted at any time, and in locations where pedestrian traffic cannot be entirely controlled, provide walkways and barricades or substitute other permissible curing methods on such sections of the concrete.

C. Membrane Method. After the concrete base or pavement has been finished as specified above, spray the concrete with a curing compound suitable for the formation of an impermeable film which will adhere integrally to concrete. Apply in a manner and quantity that will secure a uniform coverage of not more than 200 square feet for each gallon of curing compound.

The curing compound used shall contain a quick fading dye of suitable color to assure visibility during application and shall be of such ingredients as will not permanently alter the natural color of the concrete. Under the normal conditions suitable for paving operations, the curing compound after application shall dry to touch within 45 minutes and shall dry thoroughly and completely within four (4) hours. When thoroughly dry, it shall provide a continuous flexible membrane free from breaks or pin holes and will not disintegrate, check, peel or crack during the required curing period when tested to meet the requirements of ASTM C-156. The curing compound shall provide a film which will have retained within the specimen the following percentages of the moisture present in the specimen when curing compound was applied: at least 97 percent at the end of 24 hours; at least 95 percent at the end of three (3) days; and at least 91 percent at the end of seven (7) days. The efficiency of the curing compound shall be tested to meet the requirements of ASTM C-156, except that paragraph six (6) of said procedure shall be changed to read as follows: "Immediately after molding, the mold and the specimen shall be weighed to the nearest gram and placed in an atmosphere maintained at a temperature of 115 (plus or minus 5) F and at a relative humidity controlled within the limits of 40 to 45 percent. Means shall be provided for circulating the air."

3.12 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50ø F and rising, and weather is not foggy or rainy. Before work is started, the joint sealing equipment must be in first class working condition, and be approved by the Engineer. Use a concrete grooving machine or a power-operated wire brush and other equipment such as plows, brooms, brushes and blowers as required to produce satisfactory joints.

B. Clean joints of loose scale, dirt, dust and curing compound. When required, remove the joint filler to the depth shown. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

C. Fill joints neatly with joint sealer to the depth shown. Pour sufficient joint sealer into the joints so that, upon completion, the surface of the sealer within the joint will be 1/4 inch below the level of the adjacent surface or at an elevation as directed.

3.13 PROTECTION AND OPENING PAVEMENT TO TRAFFIC

A. Barricade a pavement section from use for at least 72 hours during the curing period. Concrete pavement shall be closed to all traffic including vehicles of the Contractor, until the concrete is not less than seven (7) days old and has attained the minimum average modulus of rupture or compressive strength as required by these Specifications. The period of closure to traffic may be extended if, in the opinion of the Engineer and the Owner, weather or other conditions make it advisable to provide and extension of time of protection. On those sections of pavement open to traffic, seal the joints, clean the pavement and place earth against the pavement edges before permitting use by traffic. Such opening of pavement to traffic in no way relieves the Contractor from his responsibility for the work.

3.14 TESTING

A. Laboratory Services. The Contractor will appoint a commercial laboratory. Payment for laboratory services will be as outlined in Division 1 – "General Requirements", see Section 01410.

B. Duties. Arrange for the laboratory to inspect and test materials entering the concrete and check the design of concrete mixes to meet specified strengths, uses and finishes. The lab will analyze aggregate for quality, durability, grading, and free water content. The lab will take representative specimens of ingredients and mixes; make test cylinders and measure their compressive strength. The lab will check the moisture content of aggregates and control their mix subject to approval.

C. Test Procedures. The laboratory will make tests in conformance with current standard test procedures of ASTM and AASHTO, per Section 01410.

D. Test Reports. The laboratory will promptly furnish written reports covering results of test & inspections to the Owner, the Engineer and the Contractor.

E. Test Cylinders. Three test cylinders for compressive strength test will be made for each 500 square yards or less of pavement that is placed in one day or as specified by Section 01410. Cylinders will be tested at the ages of seven (7) and twenty-eight (28) days. The required strengths at 28 days are 3000 psi compressive and 500 psi tensile, respectively. Testing for tensile strength shall be per ASTM Standards for Beam Tests. Cylinders will be made, cured and tested using applicable ASTM standards for sampling and testing.

F. Yield. Make a yield test in accordance with ASTM C-138 for cement content per cubic yard of concrete. If such cement content is found to be less than that specified per cubic yard, reduce batch weights until the amount of cement per cubic yard of concrete conforms to requirements.

3.15 WARRANTY

A. The Owner shall be provided with a two (2) year unconditional maintenance free warranty on either Portland Cement Concrete pavement or asphaltic concrete pavement. The warranty time span shall begin the date the Owner indicates final acceptance of the pavement. The warranty shall be executed by the paving subcontractor and cosigned by the General Contractor.

B. Warranty shall be submitted to Owner.

END OF SECTION 02511

SECTION 02525 – CONCRETE CURBS

PART 1: GENERAL

1.01 SCOPE

A. Perform all work required to complete, as indicated on the plans and specifications, and furnish all supplementary items necessary for the proper installation of integral and separate concrete curbs.

B. Related information or work specified elsewhere in the Project Manuals includes, but is not limited to the following:

1. General and Supplementary Conditions of the Contract
2. Division 1 – As applicable
3. Section 01410 – Testing Laboratory Services
4. Section 02200 – Earthwork
5. Section 02511 – Portland Cement Concrete Pavement

PART 2: PRODUCTS

2.01 MATERIALS

A. Concrete and related materials required for concrete curbs are specifiedin Section 02511 – "Portland Cement Concrete Pavement".

B. Mortar for mortar finish composed of one part Portland Cement and 1-1/2 parts of fine aggregate may be used when approved.

PART 3: EXECUTION

3.01 GUIDELINE

Set the guideline to follow the top line of the curb. Attach the indicator to provide a constant comparison between the top of the curb and the guideline.

3.02 FORMS

Brace forms sufficiently to maintain position during pour. Use metal templates cut to the section shown on the curb and gutter drawing. All framework must produce required grades and lines.

3.03 REINFORCEMENT

Reinforcing steel, as indicated on the plans, shall be secured in proper position so that the steel will remain in place throughout the pour.

3.04 JOINTS

Joints shall match those of the adjoining concrete pavement, unless specifically indicated otherwise on the plans, or joint spacing of existing curb and gutter for separate curb and gutter.

3.05 PLACING

Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in the form. Entirely cover the top surfaces with mortar.

3.06 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form the exposed portions of curb, using a mule which conforms to the curb shape, as shown. A thin coat of mortar, similar to the mortar used in the concrete mixture, may be worked into the exposed face of the curb using a mule and two handled wooden darby at least three feet long.

B. Before applying the final finish, use a 10 foot straight edge. Move the straight edge up the curb to the back form of the curb. Repeat until the curb is true to the grade and section. Lap straight edge every five feet.

C. Steel trowel finish surfaces to a smooth, even finish. Make the face of the finished curb true and straight. Make the top surfaces of the curb uniform width and free from humps, sags, or other irregularities. Surfaces of curb top and curb face must not vary more than 1/8 inch from the edge of a straight edge laid along them, except at grade changes.

D. Finish visible surfaces and edges of the finished curb free from blemishes, from marks and tool marks, and of uniform color, shape and appearance.

3.07 MECHANICAL FINISHING

Mechanical curb forming and finishing machines may be used instead of or in conjunction with previously described methods, with approval. Use of mechanical methods must provide the curb design and finish as specified and shown on the plans.

3.08 CURING

Immediately after finishing operations, cure the exposed surfaces of curbs and gutters in the same manner as concrete pavement.

END OF SECTION 02525

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Signed:

STATE OF TEXAS
LUIS D. CARRERA
55182
REGISTERED
PROFESSIONAL ENGINEER

Date 1-31-05

Addison Design Group, LLC
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ADG

EXPIRATION DATE:

AFFIXATION DATE:

AIRCORP
15900 DOOLEY ROAD
ADDISON, TEXAS

Job No.
00018

Plan No.

Date
31 JAN 2005

Drawn By
Ccei

Revisions
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Sheet Title
CIVIL SITEWORK SPECIFICATIONS

Sheet No.
C702