

Section 02751**CONCRETE PAVEMENT****1.0 GENERAL****1.01 SECTION INCLUDES**

- A Portland Cement Concrete Pavement for Concrete Streets, Driveways and Sidewalks; Joints and Curing Materials.

- B References to Technical Specifications:
 - 1. Section 01200 – Measurement and Payment Procedures
 - 2. Section 01350 – Submittals
 - 3. Section 01450 – Testing Laboratory Services

- C Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM C 150, “Standard Specification for Portland Cement”
 - b. ASTM C 94, “Standard Specification for Ready-Mixed Concrete”
 - c. ASTM C 33, “Standard Specification for Concrete Aggregates”
 - d. ASTM C 131, “Standard Test Methods for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine”
 - e. ASTM C 136, “Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates”
 - f. ASTM C 40, “Standard Test Method for Organic Impurities in Fine Aggregates for Concrete”
 - g. ASTM C 260
 - h. ASTM C 494, “Standard Specification for Chemical Admixtures for Concrete”
 - i. ASTM A 615, “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”
 - j. ASTM D 994, “Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)”
 - k. ASTM D 1751, “Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Type)
 - l. ASTM D 6690, “Standard Specification for Joint and Crack Sealants, Hot-Applied, for Concrete and Asphaltic Pavements”
 - m. ASTM C 39, “Standard Test Method for Compressive Strength of Concrete”
 - n. ASTM C 31, “Standard Practice for Making and Curing Concrete Test Specimens in the Field”
 - o. ASTM C 143, “Standard Test Method for Slump of Hydraulic Cement Concrete”

- p. ASTM C 138, “Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete”
- q. ASTM C 231, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method”
- r. ASTM C 171, “Standard Specification for Sheet Materials for Curing Concrete”
- s. ASTM C 309, “Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete”
- t. ASTM C 42, “Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete”
- 2. Texas Department of Transportation (TxDOT)
 - a. Tex-406-A, “Material Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)”
 - b. Tex-203-F, “Sand Equivalent Test”
 - c. Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, 2004 Adoption
 - 1) Item 438 “Cleaning and Sealing Joints and Cracks (Rigid Pavements and Bridge Decks)”

1.02 MEASUREMENT AND PAYMENT

- A Measurement for concrete paving is on square yard basis. Separate measurement will be made for each different required thickness of pavement.
- B Payment includes all labor and materials required for installation of concrete paving, joints and curing material, as indicated on Plans.
- C Refer to Section 01200 – Measurement and Payment Procedures.
- D Refer to this Section, 3.26 “Nonconforming Pavement” for unit price adjustments for deficient thickness.

1.03 SUBMITTALS

- A Make Submittals required by this Section under the provisions of Section 01350 – Submittals. Submittals shall conform to requirements of Section 01350 - Submittals.
- B Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual compressive strength obtained from design mixes at required test ages.
- C Submit manufacturer's description and characteristics for mixing equipment, and for traveling form paver, if proposed for use, for approval.
- D Submit manufacturer's certificates giving properties of reinforcing steel. Provide specimens for testing when required by the Engineer.

- E Submit product data for joint sealing compound and proposed sealing equipment for approval.
- F Submit samples of dowel cup, metal supports, and deformed metal strip for approval.

1.04 HANDLING AND STORAGE

- A Do not mix different classes of aggregate without written permission of the Engineer.
- B Class of aggregate being used may be changed before or during Work with written permission of the Engineer. New class shall comply with specifications.
- C Segregated aggregate will be rejected. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.
- D Aggregates mixed with dirt, weeds or foreign matter will be rejected.
- E Do not dump or store aggregate in roadbed.

2.0 PRODUCTS

2.01 MATERIALS

- A Portland Cement:
 - 1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.
 - 2. 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: Conform to requirements for water in ASTM C 94.
- C Coarse Aggregate: Gravel or crushed stone, or combination thereof, which is clean, hard, durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131). No pit run gravel will be allowed.
 - 1. Maximum percentage by weight of deleterious substances shall not exceed following values:

ITEM	PERCENT BY WEIGHT OF TOTAL SAMPLE MAXIMUM
Clay lumps and friable particles.	3.0
Material finer than 75- μ m (No. 200) sieve:	
Concrete subject to abrasion.	3.0*

All other concrete.	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance.	0.5
All other concrete.	1.0

* In case of manufactured sand, if material finer than 75- μ m (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Coarse aggregate (size 1 1/2 inch to No. 4 sieve) shall conform to requirements of ASTM C 33. Gradation shall be within following limits when graded in accordance with ASTM C 136:

SIEVE DESIGNATION (SQUARE OPENINGS)	(PERCENTAGE BY WEIGHT)
Retained on 1 3/4 inch sieve	0
Retained on 1 1/2 inch sieve	0 to 5
Retained on 3/4 inch sieve	30 to 65
Retained on 3/8 inch sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test	
*Method Tex-406-A	1.0 maximum

* In case of aggregates made primarily from crushing of stone, if material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of Tex-406-A, percent may be increased to 1.5

- D Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Fine aggregate for concrete shall conform to requirements of ASTM C 33. Gradation shall be within following limits when graded in accordance with ASTM C 136:

SIEVE DESIGNATION (SQUARE OPENINGS)	(PERCENTAGE BY WEIGHT)
Retained on 3/8 inch sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90

Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Plans.
- E Air Entraining Agent: Furnish an air entraining agent conforming to requirements of ASTM C 260.
- F Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used if required to improve the workability of concrete. Amount and type of such admixture shall be subject to approval by the Engineer.
- G Reinforcing Steel:
1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil or other injurious materials.
 2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.

2.02 CONCRETE JOINTS

- A When allowed on the Plans, or with approval of the Engineer, Board Expansion Joint Material may be used: Filler board of selected stock. Use wood of density and type as follows:
1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
 2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.
 3. Use wood only when part of a load transmission device assembly.
- B Unless specified otherwise, use Preformed Expansion Joint Material: Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.
- C Joint Sealing Compound:
1. Hot poured rubber-asphalt compound meeting the requirements of ASTM D 6690.
 2. When indicated on Plans, self-leveling Low Modulus Silicone sealant single component meeting the requirements of TxDOT Specification 438.
- D Load Transmission Devices:

1. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Plans, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.
 2. Deformed steel tie bars conforming to ASTM A 615, Grade 60.
- E Metal Supports for Reinforcing Steel and Joint Assembly: Employ metal supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by the Engineer.

2.03 EQUIPMENT

- A Equipment: Conform to requirements of ASTM C 94.

2.04 MIXING

- A Employ and pay certified testing laboratory to prepare mix designs. Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Contractor shall determine and measure batch quantity of each ingredient, including all water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Plans.
- B Mix design to produce concrete which will have a minimum compressive strength of 2500 psi at 7 days and 3500 psi at 28 days. When high-early-strength cement is used, it shall reach a minimum compressive strength of 3500 psi at 7 days and 4000 at 28 days. Slump of concrete shall be at least 2 inch, but no more than 5 inches, when tested in accordance with ASTM C 143.
1. Concrete pavement shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water cement ratio maximum 0.57). Cement content shall be determined in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.
 2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.
 3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Air content shall be determined by testing in accordance with ASTM C 231.
 4. Use retardant when temperature exceeds 90 degrees F. Proportion shall be as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent. Accelerators will not be allowed unless approved by the Engineer.

2.05 COVER MATERIALS FOR CURING

- A Curing materials shall conform to one of following:
1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.
 2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.
 3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Mats shall be stitched so that mat will contact surface of pavement at all points when saturated with water.
 4. Liquid Membrane-forming Compounds: Liquid membrane-forming compounds shall conform to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m² of surface in 72 hours.

3.0 EXECUTION

3.01 EXAMINATION

- A Verify compacted base is ready to support imposed loads and meets compaction requirements.
- B Verify lines and grades are correct.

3.02 PREPARATION

- A Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.
- B Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.03 EQUIPMENT

- A Alternate equipment and methods, other than those required by this article, may be used provided the Contractor demonstrates that equal, or better, results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order. Unless approved otherwise by the Engineer or the Plans, slip form paving methods shall be used.
- B Subgrade Planer and Template:
1. Use subgrade planer with adjustable cutting blades to trim subgrade to exact section shown on Plans. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form

at all times, and have such strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8 inch. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.

2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have such strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8 inch. Fit template with accurately adjustable rods projecting downward at 1 foot intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.

C Texturing Equipment

1. Carpet Drag

- a. Provide a carpet drag mounted on a work bridge or a moveable support system. Provide a single piece of carpet of sufficient transverse length of carpet is in contact with the concrete being placed to produce the desired texture.

- D Machine Finisher:** Provide a power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires if it operates on concrete pavement.

E Hand Finishing:

1. Provide mechanical strike and tamping template 2 feet longer than width of pavement to be finished. Shape template to pavement section.
2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.

- F Vibrators:** Furnish mechanically operated synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.

3.04 FORMS

- A Side Forms:** Use clean metal forms of approved shape and section. Preferred depth of form shall be equal to required edge thickness of pavement. Forms with depths greater or less than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness is not greater than 1 inch, and further provided that forms of depth less than pavement edge are brought to required edge thickness by securely attaching wood or metal strips to bottom of form, or by grouting under form.

Bottom flange of form shall be same size as thickness of pavement. Aluminum forms are not allowed. All forms shall be approved by the Engineer. Length of form sections shall be not less than 10 feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200 foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. In no case shall base width be less than 8 inches for form 8 inches or more in height. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide reasonable straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10 feet in length or curved forms may be used. For curb returns at street intersections and driveways, wood forms of good grade and quality may be used.

B Form Setting:

1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 feet of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300 feet ahead of mixer or as approved by the Engineer.
2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. These adjacent slabs shall not be used for forms until concrete has aged at least 7 days.

3.05 REINFORCING STEEL AND JOINT ASSEMBLIES

- A** Accurately place reinforcing steel and joint assemblies and position them securely as indicated on Plans. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Place all reinforcing steel and secure to chairs. All reinforcing steel must be positively supported before pour begins.
- B** Place pavement joint assemblies at required locations and elevations, and rigidly secure all parts in required positions. Install dowel bars accurately in joint assemblies as shown, each parallel to pavement surface and to center line of pavement. Rigidly secure in 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. Drill dowels into existing pavement, secure with epoxy, and provide paving headers, as required, to provide rigid pavement sections.

3.06 PLACEMENT

- A Place concrete only in rain-free days when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Concrete shall not be placed when temperature is below 40 degrees F and falling.

Place concrete that is between 40 degrees F and 95 degrees F at the time of discharge. Do not exceed 60 minutes between introduction of cement to the aggregates and discharge. When the weather is such that the concrete temperature would exceed 90 degrees F, employ effective means, such as pre-cooling of aggregates and mixing water, using ice or placing at night, as necessary to maintain concrete temperature, as placed, below 95 degrees F. Do not place when concrete temperature is above 95 degrees F at the time of discharge.

- B Place concrete within 60 minutes of mixing. Remove and dispose of concrete not placed within this period.
- C Concrete slump during placement shall be 2 to 5 inches, except when using traveling-form paver slump shall be a maximum of 3 inches.
- D Deposit concrete rapidly and continuously on subgrade or subbase in successive batches. Distribute concrete to required depth and for entire width of placement in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At end of day or in case of unavoidable interruption of more than 30 minutes, place transverse construction joint at point of stopping work. Remove and replace sections less than 10 feet long.
- E Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.07 FINISHING

- A Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods.
1. Use transverse finishing machine to make at least two trips over each area. Make last trip continuous run of not less than 40 feet. After transverse screeding, use hand-operated longitudinal float to test and level surface to required grade.
 2. Hand finish with mechanical strike and tamping template as wide as pavement to be finished. Shape template to pavement section. Move strike template forward in direction of placement, maintaining slight excess of material in front of cutting edge. Make at least two trips over each area. Scream pavement surface to required section. Work screed with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.

- B On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.
- C While concrete is still workable, give surface final belting to produce a uniform surface of gritty texture. Perform belting with short rapid transverse strokes having sweeping longitudinal motion.

3.08 JOINTS AND JOINT SEALING

- A When new work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.
- B If the limit of removal of existing concrete or asphaltic pavement does not fall on existing joint, saw cut existing pavement minimum of 1 1/2 inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.09 CONSTRUCTION JOINTS

- A Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 5 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.10 EXPANSION JOINTS

- A Place 3/4 inch expansion joints at locations shown on Plans. Use no filler shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of filler. Secure pieces to form straight joint. Shape filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Plans. Seal with joint sealing compound.

3.11 CONTRACTION JOINTS

- A Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Plans. Maximum spacing of contraction/construction joints, 20 feet. Seal groove with joint sealing compound.

3.12 LONGITUDINAL WEAKENED PLANE JOINTS

- A Place longitudinal weakened plane joints at spaces indicated on Plans. Seal groove with joint sealing compound.

3.13 SAWED JOINTS

- A Contractor may use sawed joints as an alternate to contraction and weakened plane joints. Circular cutter shall be capable of cutting straight line groove minimum of 1/2 inch wide. Depth shall be one quarter of pavement thickness plus 1/2 inch. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, it shall be continued until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.
- B Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Provide at least one standby saw in good working order. Maintain an ample supply of saw blades at work site at all times during sawing operations. Sawing equipment shall be on job at all times during concrete placement.

3.14 JOINTS FOR CURB, AND CURB AND GUTTER

- A Place 3/4 inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement; at end of radius returns at street intersections and driveways; and at curb inlets. Maximum spacing shall be 60 foot centers.

3.15 JOINTS FOR CONCRETE DRIVEWAYS

- A Provide 3/4 inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab. Where dowels are used, wrap or sleeve one end.

3.16 JOINT SEALING

- A Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F but less than 85 degrees F, and weather is not foggy or rainy.
- B Joint sealing equipment shall be in first-class working condition, and be approved by the Engineer. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.
- C Clean joints of loose scale, dirt, dust and curing compound. 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.

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

3.17 CONCRETE CURING

- A Concrete pavement shall be cured by protecting it against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphaltic concrete.
- B Where curing requires use of water, curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.18 POLYETHYLENE FILM CURING

- A Immediately after finishing surface, and after concrete has taken its initial set, apply water in the form of a fine spray. Cover surface with polyethylene film so film will remain in intimate contact with surface during specified curing period.
- B Cover entire surface and both edges of pavement slab. Joints in film sheets shall overlap minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or by replacing.

3.19 WATERPROOFED PAPER CURING

- A Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in intimate contact with surface during specified curing period.
- B Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Joints in blankets caused by joining paper sheets shall lap not less than 5 inches and shall be securely sealed with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure an overlap of at least 12 inches. Tears or holes appearing in paper during curing period shall be immediately repaired by cementing patches over defects.

3.20 COTTON MAT CURING

- A Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, in such manner that they will contact surface of pavement equally at all points.
- B Mats shall remain on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.21 LIQUID MEMBRANE-FORMING COMPOUNDS

- A Immediately after finishing surface, and after concrete has taken its initial set, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

3.22 TOLERANCES

- A Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10 foot straightedge parallel to center of roadway to bridge any depressions and touch all high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16 inch per foot from nearest point of contact. Maximum ordinate with 10 foot straightedge shall not exceed 1/8 inch. Grind spots in excess of requirements of this paragraph to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.23 FIELD QUALITY CONTROL

- A Testing will be performed under provisions of Section 01450 – Testing Laboratory Services.
- B Test Specimens: Four test specimen cylinders for compressive strength tests will be made for each 150 cubic yards or less of pavement that is placed in one day. Two specimens will be tested at 7 days. For failed 7-day tests, remaining two specimens will be tested at 28 days. Specimens will be made, cured and tested in accordance with ASTM C 31 and ASTM C 39.
- C Yield test will be made 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 amount of cement per cubic yard of concrete conforms to requirements.
- D At the Engineer's direction a minimum of one 4-inch core may be taken at random locations per 1,000 feet per lane or 500 square yards of pavement to measure in-place depth. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. The 28 day compressive strength of each core tested shall be a minimum of 3000 pounds per square inch.
- E Contractor may, at his own expense, request three additional cores in vicinity of cores indicating nonconforming in-place depths. In-place depth at these locations shall be the average of depth of four cores.
- F Fill cores and density test sections with new concrete paving or non shrink grout.

3.24 NONCONFORMING PAVEMENT

- A Remove and replace areas of pavement found by cores to be deficient in thickness by more than 10 percent, or that fail compressive strength tests, with new concrete pavement of thickness shown on Plans at no cost to the Owner.
- B Areas of concrete pavement found by cores to be deficient in thickness by less than 10 percent shall be remedied at the Owner's direction by one of the following methods:
 - 1. Remove and replace using new concrete pavement of thickness shown on Plans and in accordance with the requirements of this Section at no cost to Owner.
 - 2. Reduce the Unit Price by the ratio of the average thickness (as determined by cores) to the thickness required.
- C No adjustments will be made for excess thickness.

3.25 PAVEMENT MARKINGS

- A Restore pavement markings to match those existing in accordance with City of Pearland Standard Details and the Engineer's requirements.

3.26 PROTECTION

- A Barricade pavement section from use until concrete has attained minimum design strength.
- B On those sections of pavement to be opened to traffic, seal joints, clean pavement and place earth against pavement edges before permitting use by traffic. Such opening of pavement to traffic shall not relieve Contractor from his responsibility for Work.
- C Maintain concrete paving in good condition until completion of Work.
- D Repair defects by replacing concrete to full depth.

END OF SECTION