TECHNICAL SPECIFICATIONS

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Except where specifically noted otherwise in the contract documents, all provisions of pertinent items of the Texas Department of Transportation 2004 Standard Specifications for Construction of Highways, Streets and Bridges shall govern all work to be done under this Contract.

All work under this contract is to be in accordance with the Standards and Specifications for the Acceptance of Public Improvements for the ENGINEER.

If there is a conflict between TxDOT and City Specification, the more stringent shall control unless otherwise authorized by the ENGINEER.

Any conflicts between TxDOT or City Specification and the following Technical Specifications, the project's Technical Specification shall govern.

Copies of the City's Specification are available for review at the Public Works Department, or are available for purchase for $25.00 per set.

PAYMENT

The City will pay the contractor ninety (90) percent upon completion of the work, and the remaining ten (10) percent upon final completion of all restoration and acceptance by the City of South Padre Island.

Payment for H.M.A.C. Overlay shall be all complete, in place, and includes Tack Coat.

Payment for Full Depth Reclamation shall be all complete, in place, and includes removal and disposal of existing materials, compaction of the subgrade and aggregate, prime coat, saw cutting, compaction, cement stabilization, and final grading. Portland Cement will be paid for separately, by the ton.

Payment for manhole adjustment/treatment shall be all complete, and includes all labor materials, equipment, tools and incidentals.

Payment for flexible base shall be complete, in place, and includes all labor, equipment, material, compaction, and final grading.

FLEXIBLE BASE TYPE B GRADE 2 OR 3 (CALICHE)

A. DESCRIPTION

The work covered by this section consists of the hauling, placing, spreading, sprinkling, shaping, and compaction of Flexible Base Material on the approval subgrade in accordance with specification requirements herein outlined and in conformity with the required lines, grades, and typical cross sections shown on the plans.

B. MATERIAL

Flexible Base:
The flexible base shall be Type B, Grade 2 or 3, Texas Department of Transportation, 2004, Standard Specification for Construction and Maintenance of Highways, Street, and Bridges, "Item 247 Flexible Base".

C. CONSTRUCTION METHODS

Immediately before placing the base material, the subgrade shall be check as to conformity with grade and section.

The material shall be delivered in approved vehicles of a uniform capacity and it shall be the charge of the Contractor that the required amount of specified material shall be delivered in each 100-foot station. Material deposited upon the subgrade shall be spread and shaped the same day, unless otherwise directed by the Department of Public Works and the ENGINEER in writing. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period. The material shall be scarified and spread as directed by the Department of Public Works and the ENGINEER. The material shall be sprinkled, if directed, and shall then be bladed, dragged and shaped to conform to typical section as shown on the plans. All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well graded material, as directed by the Department of Public Works and the ENGINEER. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and applied in the amount directed by the Department of Public Works and the ENGINEER. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming, or by other approved methods.

The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the present density as hereinafter specified in the Plans. In addition to the requirements specified for density, the full depth of flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of flexible base is completed, tests as necessary will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. Throughout this entire operation the shape of the

course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to the established lines and grades. In that area on which pavement is to be placed, any deviation in excess of ¼ inch in cross section and in a length of 12 feet measured longitudinally shall be corrected by loosening, adding, or removing material, reshaping and recompacting by sprinkling and rolling. All irregularities, depressions, or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable by sprinkling and rolling. Should the base course, due to any reason or cause, lose the required stability, density, and finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the Contractor.

D. MEASUREMENTS

"Full Depth Repair" will be measured by the square yard, complete in place as planned, detailed, and specified.

Flexible Base will be measured by the ton, complete in place, as specified.

E. PAYMENT

This item will be paid for at the Contract Unit Price Bid for "Full Depth Repair" which prices shall include full compensation for all materials, equipment, tools, labor, and any incidentals necessary to complete the work.

Flexible Base will be paid for at the Contract Unit Price and shall include full compensation for all materials, equipment, labor and any incidentals necessary to complete the work.

FLEXIBLE BASE TYPE A GRADE I (CRUSHED LIMESTONE)

A. DESCRIPTION

This item shall govern the material placement and compaction of Crushed Limestone Base to the lines and grades that are shown on the construction drawings. Crushed Limestone Base thickness for various pavement types are shown on the plans.

B. MATERIAL

The Crushed Limestone material shall be Type A, Grade I Texas Department of Transportation, 2004, Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, “Item 247 Flexible Base”.

The Contractor shall not place crushed limestone on the road bed until the Department of Public Works and the ENGINEER has accepted the shaped and compacted subgrade.

The Contractor must maintain the roadbed free of holes, ruts and depressions and in condition to receive the crushed limestone.

The Contractor upon request shall provide certification that the material supplied meet the above requirements prior to delivery to the job site. Samples for testing of the material must be taken prior to the compaction operations.

C. CONSTRUCTION METHODS

The flexible base material shall be placed on the approved subgrade in courses not to exceed six (6) inches compacted depth. It shall be the responsibility of the contractor that the required amount of material be delivered and uniformly spread and shaped. All materials has been cut into the windows, it shall be sprinkled, spread, and rolled in proper sequence to prevent segregation and as necessary for required compaction.

The surface on completion shall be smooth and in conformity with typical sections and to the established lines and grades. Any deviation in excess of ¼ inch in cross-section and in length of 16 feet measured longitudinally shall be corrected.

Flexible base shall be compacted to an apparent dry density of not less that 98 percent of the maximum dry density as determined in accordance with ASTM Test method D698 (Standard Proctor). Tests for density will be made within 24 hours after compaction operations are completed. If the material fails to meet the density specified, it shall be reworked as necessary to meet the density required. Prior to placing any succeeding course of flexible base or surfacing on a previously completed course the density and moisture of the top three (3) inches of flexible base shall be checked and if the test show the density to be more than 2 percent below the specified compaction and moisture content, it shall be reworked as a necessary the density and moisture required.

The first density and depth test as a specific location will be made by commercial testing laboratory designated by the Owner and said tests shall be paid for the Owner. If the test fails, all other tests at the location shall be paid for by the Contractor, by deducting from the final payment.

D. MEASUREMENT & PAYMENT

This item “Full Depth Repair” will be measured by the square yard complete in place as planned and detailed on the cross-section. “Full Depth Repair”, price shall include full compensation for all materials, for water required and for all equipment, tools, labor and incidentals necessary to complete the work to the required compaction.

HOT MIX ASPHALTIC CONCRETE PAVEMENT

A. DESCRIPTION

This item shall consist of a base course, a leveling-up course, a surface course, or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

The pavement shall be constructed on the previously completed and approved subgrade, base, existing pavement, bituminous surface, or in the case of a bridge, on the prepared floor slab, as herein specified and in accordance with the details shown on the plans.

B. MATERIAL

Hot Mix Asphaltic Concrete, Type "D" (fine graded surface course). The hot mix asphaltic concrete shall conform to the requirements of the Texas Department of Transportation, 2004 Standard Specifications for Construction and maintenance of Highway, Streets, and Bridges, "Item 340 Dense-Graded Hot-Mix Asphalt". The successful bidder shall submit an asphalt mix design within ten (10) days upon award of contract to ENGINEER demonstrating that the hot mix asphaltic concrete to be used meets these specifications. The asphalt to be used shall be PG 64-22. Special Modifications to Standard Specification Item 2-340, for this project are as follows:

1. Asphalt Content. Asphaltic Material PG 64-22 shall form from a percent of the mixture by weight obtained from the approved Job Mix Formula (JMF).

2. Hveem Stability. Hveem stability shall not be less than 30.

C. CONSTRUCTION METHODS

Construction methods used in Hot Mix Asphaltic Concrete Pavement shall meet the requirements as set form in the Texas Department of Transportation, 2004 Standard Specifications for Construction and maintenance of Highway, Streets, and Bridges, "Item 340 Dense-Graded Hot-Mix Asphalt", with the following additions:

If the temperature of the asphaltic mixture of a load of any part of a load becomes less than 225^{o}F or more than 350^{o}F after being dumped from the mixer and prior to passing through the lay-down machine, all or any part of the load may be rejected.

1. Transporting Asphaltic Concrete. The asphaltic mixture, prepared as specified above, shall be hauled to the work in tight vehicles previously cleaned of all foreign material. The dispatching of the vehicles shall be arranged so that all material delivered may be placed, and all rolling shall be completed during daylight hours. In cool weather or for long hauls, canvas covers and insulating of the truck bodies may be required. The inside of the truck body may be given a light coating of oil, lime slurry, or other material satisfactory to the Department of Public Works

Director and/or the ENGINEER, if necessary, to prevent mixture from adhering to the body.

2. Placing

   a. Generally, the asphaltic mixture shall be dumped and spread on the approved prepared surface with specified spreading and finishing machine, in such manner that when properly compact the finished pavement will be smooth, of uniform density and will meet the requirements of the typical cross sections and the surface tests. Spreading machine must have electronic controls and be able to lay a minimum of 19 feet of asphalt per pass. During the application of asphaltic material, care shall be taken to prevent splattering of adjacent pavement, curb, gutter and structures.

   b. In placing a level-up course with the spreading and finishing machine, binder twine or cord shall be set to line and grade established by the Department of Public Works and the ENGINEER. If approved by the Department of Public Works and the ENGINEER, level-up courses may be spread with a motor grader.

   c. When the asphaltic mixture is placed in a narrow strip along the edge of an existing pavement, or used to level up small areas of an existing pavement or placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated when authorized by the ENGINEER, provided a satisfactory surface can be obtained by other approved methods.

   d. Flush Structures. Adjacent to flash curbs, gutters, liners, and structures, the surface shall be finished uniformly high so that when compacted it will be slightly above the edge of the curb or flush structure.

3. Conditions for Placement. The asphaltic mixture when placed with a spreading and finishing machine shall not be placed when the air temperature is below $50^{o}F$ and is falling, but it may be when the air temperature is above $50^{o}F$ and is rising. The air temperature shall be taken in the shade away from artificial heat. It is further provided that the asphaltic mixture shall be placed only when the humidity, general weather conditions, temperature, and moisture conditions of the base, in the opinion of the ENGINEER, are suitable.

4. Compacting

   a. Rolling with the three-wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheel unless otherwise directed by the Department of Public Works and the ENGINEER. Alternative trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Department of Public Works and the ENGINEER. Rolling with pneumatic-tire roller shall be done as needed. Rolling shall be continued until not further compression can be obtained and all roller markers are eliminated. One tandem roller, one pneumatic-tire roller and at least one three-wheel roller as specified above shall be provided for each job. If the Contractor elects, he may substitute the three-axle tandem roller for the two-axle tandem roller but in no case shall less than three rollers be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixtures when required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease, or other foreign matter on the pavement, either when the rollers are in operation or when standing.

      In lieu of the rolling equipment specified, the Contractor may, upon written permission from the ENGINEER, operate other compacting equipment that will produce equivalent relative compaction as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction as would be expected of the specified equipment, as determined by the ENGINEER, its use shall be discontinued.

   b. Hand Tamping. The edges of the pavement along curbs, headers, and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction may be compacted using lightly oiled tamps.

5. Opening to Traffic. The pavement shall be opened to traffic when directed by the Department of Public Works and the ENGINEER. The Contractor's attention is directed to the fact that all construction traffic allowed on pavement open to public will be subject to the laws governing traffic on Public Roads and Streets.

If the surface ravels or presents a rough appearance, it will be the Contractor's responsibility to correct this condition at his expense. A fog seal and/or sand seal will be applied.

6. Density Test. Acceptance of Sampling andTesting of Hot Mix Asphaltic Concrete (Compaction):

   Hot Mix Asphaltic Concrete will be accepted for density on lot basis. A lot will consist of 5,000 square feet of paving area. One test shall be made for each lot.

   Each lot of pavement will be accepted with respect to density, when the average field density is compacted between 91% and 97% as determined in accordance with ASTM D2041, and when no individual determination is less that 90% of the average laboratory density. Four field density determinations will be made for each lot. A Nuclear Gauge will be used to determine field density during laying of the HMAC. The densities shall be determined in accordance with ASTM D2950. The number of tests will be determined by this specification or by request of the ENGINEER. An asphalt sample specimen shall be provided to the testing laboratory for determining the maximum theoretical density and laboratory density. If heating is necessary, the specimen shall be heated to the lowest temperatures required for proper preparation of the sample.

7. Surface Tests. Tests for conformity with the specified crowns and grade shall be made by the Contractor immediately after final rolling. Any variation exceeding the specified tolerances shall immediately be corrected by removing the defective work and replacing with new material, as directed by the ENGINEER. Any correction required shall be at the sole expense of the Contractor.

   For surface course, the finished surface shall not vary more than ¼ inch (6.3mm), when tested with a 16 foot straightedge applied parallel with, or at right angles to the centerline.

   The finished surfaces of hot mix asphaltic concrete shall not vary from the gradeline, elevations and cross sections shown on the plans by more than ¼ inch (6.3 mm). The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching shall not be permitted for correction of low areas nor shall be permitted for correction of high areas.

8. Sampling Pavement. Samples for determination of thickness and density of completed pavements shall be obtained by the Owner. The size, number, and

locations of the samples will be as directed by the Department of Public Works and the ENGINEER.

All tests necessary to determine conformance with the specified requirements will be performed without cost to the Contractor; however, any required retests shall be performed at the Contractor's expense.

Upon delivery of the Hot Mix Asphaltic Concrete to the site, the Owner will hire a reputable commercial Testing Laboratory to sample the material and run laboratory tests to verify that the mixture conforms to project specifications (Gradation, Extraction, and Stability).

ADJUSTING MANHOLES CLEANOUTS, INLETS & WATER VALVE RISERS

A. DESCRIPTION

This item shall govern for the furnishing of materials and for adjusting manholes, cleanouts inlets or water valve risers where required by the plans. Manholes, cleanouts, inlets and water valve risers shall be adjusted to position and/or elevation as shown on the plans, or as ordered by the Department of Public Works and the ENGINEER and in accordance with these specifications.

B. MATERIALS

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Manhole, cleanout, and inlet covers, water valve risers, and brick in good condition, removed in the process of adjustment, may be re-used. Additional materials needed shall be provided as needed.

Mortar for brick work shall be composed of one part Portland Cement and two parts clean, sharp mortar sand suitably graded for the purpose. Lime may be added to the mix but in no case shall it exceed 10% by weight of the total dry mix.

Bricks for Sanitary Sewer Manholes shall be concrete brick conforming to the requirements of ASTM Designation C 32, Grade NA or equal.

Concrete for inlets shall be 4000 psi (28 day compressive strength) concrete containing a minimum of 6 sacks of cement per cubic yard.

Reinforcing steel shall be deformed and shall conform to ASTM Designation A-615.

When prefabricated steel extension rings are furnished, the material shall be ASTM A36 or equal.

C. CONSTRUCTION

Existing manholes, cleanouts and water valve risers located within areas of base and sub-base construction shall be located and referenced; covers, and risers shall be removed carefully and stored by the Contractor. Rings, covers, plates, or grates broken in the process of removal and cleaning lost or stolen shall be replaced in kind by the Contractor at his expense. Manholes shall be broken down below subgrade elevation and covered with hatch covers prior to beginning excavation and subgrade preparation. If manholes are to be lowered the brick work shall be removed to a point where the corbell will not exceed 1” per course of brick, in order to obtain the proper diameter at the top for resetting the ring and cover. Upon completion of the flexible base, the manholes, and the water valves shall be located from the reference points and the top portion of the manhole rebuilt, and water valve risers reset so that they will be within ½ inch of the proposed asphalt surfacing.

When manholes are located within pavement areas to be overlaid with hot mix asphaltic concrete, the Contractor may, upon removal of the cast iron ring and adding concrete adjustment rings, provide prefabricated steel extension rings. They shall be either of the one-piece or two-piece type as necessary for the amount of adjustment. They will be installed in accordance with the manufacturer's instructions.

Inlets to be adjusted shall be broken down as necessary and rebuilt to the elevations as shown on the plans.

D. MEASUREMENT & PAYMENT

This item; "ADJUSTING MANHOLES CLEANOUTS, INLETS & WATER VALVE RISERS", will be measured and paid for under a per item basis. The unit price shall include full compensation for all

materials, equipment, tools, labor, and incidentals necessary to complete the work to the required.

DETOUR, BARRICADE AND WARNING SIGNS

The Contractor shall place and maintain in good condition, standard barricades and warning signs at each end of the project and at other locations to maintain the safety of the public and employees.

All barricades and signs remaining in place at night and all points of hazard to traffic shall be illuminated by flares, flashers or both, as determined by the Department of Public Works and the ENGINEER.

Upon completion of the work, all signs and evidence thereof shall be removed by the Contractor.

All materials furnished and work performed under these provisions will not be paid for directly, but shall be considered as subsidiary work pertaining to the various bid items of the contract.

No direct payment shall be made to the Contractor for any temporary detours which may be needed during the construction of this project.

PRIME COAT

A. DESCRIPTION

"Prime Coat" shall consists of an application of asphaltic material on the completed base course and/or other approved areas in accordance with these specifications as directed by the Inspector.

B. MATERIALS

The asphaltic material for prime coat shall meet the requirement for Cut-Back Asphalt, MC-30, Item 300, "Asphalt, Oils, and Emulsions" of the Texas highway Department Standard Specifications 2004 Edition.

C. CONSTRUCTION METHODS

When, in the opinion of the Inspector, the area and/or base is satisfactory to receive the prime coat, the surface shall be cleaned by sweeping or other approved methods as directed by the Inspector. If directed by the Inspector, the surface shall be lightly sprinkled with water just prior to application of the asphaltic material. The asphaltic material shall be applied on the clean surface by an approved distributor at a rate not to exceed 0.2 and not below 0.1 gallons per square yard of surface, evenly, and smoothly, under a pressure necessary for proper distribution. During the application of prime coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutter or structures.

Prime coat shall not be applied when the air temperature if below 60^{o}F and falling, but may be applied when the air temperature is about 50^{o}F and is rising; the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Inspector, are not suitable.

D. MEASUREMENT & PAYMENT

The work performed and materials furnished as prescribed by this item will not be paid for separately. The cost of prime coat material, cleaning the area and/or base; for furnishing, heating, hauling, and distributing the prime coat as specified, for all freight involved and for all manipulations, labor, tool, equipment, and incidents necessary to complete the work shall be included in the unit price for "Hot Mix Asphaltic Concrete".

TACK COAT

A. DESCRIPTION

"Tack Coat" shall consist of an application of asphaltic material on the existing pavement in accordance with these specifications as directed by the Inspector.

B. MATERIALS

The asphalt material for tack coat shall meet the requirement for Cut-Back Asphalt, RC-250, Item 3000, "Asphalt, Oils, and Emulsions" of the Texas Highway Department Standard Specifications 2004 Edition.

C. CONSTRUCTION METHODS

When, in the opinion of the Inspector, the existing pavement base is satisfactory to receive the tack coat, the surface shall be cleaned by sweeping or other approved methods as directed by the inspector. The asphaltic material shall be applied on the clean surface by an approved distributor at a rate not to exceed 0.11 or below 0.05 gallons per square yard of surface, evenly, and smoothly, under a pressure necessary for proper distribution. During the application of tack coat, care shall be taken to prevent splattering of adjacent curb and gutter or structures.

Tack coat shall not be applied when the air temperature is below 60^{o}F and falling, but may be applied when the air temperature is about 50^{o}F and is rising; the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Inspector, are not suitable.

D. MEASUREMENT & PAYMENT

The work performed and materials furnished as prescribed by this item will not be paid for separately, the cost of tack coat material, cleaning the existing payment, furnishing, heating, hauling, and distributing the tack coat as specified, for all freight involved and for all manipulations, labor, tools, equipment, and incidentals necessary to complete the work shall be included in the unit price for "Hot Mix Asphaltic Concrete".

FULL DEPTH RECLAMATION

1. Description. Mix and compact cement, water, and subgrade or base (with or without asphalt concrete pavement) in the roadway. All references to “Item #’s” refer to TxDOT specs.

2. Materials. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Use Tex-100-E for material definitions.

A. Cement. Furnish hydraulic cement that meets the requirements of DMS-4600, "Hydraulic Cement," and the Department's Hydraulic Cement Quality Monitoring Program (HCQMP) Sources not on the HCQMP will require testing and approval before use.

B. Flexible Base. Furnish base material that meets the requirements of Item 247, "Flexible Base," for the type and grade shown on the plats, before the addition of cement.

C. Water. Furnish water free industrial waste and other objectionable material.

D. Asphalt. When permitted for curing purposes, furnish asphalt or emulsion that meets the requirements of Item 300, "Asphalt, Oils, and Emulsions," as shown on the plans or directed.

E. Mix Design. The Engineer will determine the target cement content and optimum moisture content to produce a stabilized mixture that meets the strength requirements shown on the plans. The mix will be designed in accordance with Tex-120-E or will be based on prior experience with the project materials. When treating existing materials, limit the amount of asphalt concrete pavement to no more than 50% of the mix unless otherwise shown on the plans or directed.

3. Equipment. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Item 210, "Rolling." Provide proof rollers in accordance with Item 216, "Proof Rolling," when required.

A. Cement Storage Facility. Store cement in closed, weatherproof containers.

B. Cement Slurry Equipment. Use slurry tanks equipped with agitation devices to slurry cement on the project or other approved location. The Engineer may approve other slurrying methods. Provide a pump for agitating the slurry when the distributor is not equipped with an agitator. Equip the distributor truck with an approved sampling device.

C. Pulverization Equipment. Provide pulverization equipment that:

- cuts and pulverizes material uniformly to the proper depth with cutters that will plane to a uniform surface over the entire width of the cut,
- provides a visible indication of the depth of cut at all times, and
- uniformly mixes the materials.

4. Construction. Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

A. Pulverization. Pulverize or scarify existing material after shaping so that 100% passes a 2-1/2 in. sieve. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve

processing to plan depth.

B. Application of Cement. Uniformly apply cement using dry placement unless otherwise shown on the plans. Add cement at the percentage required. Apply cement only on an area where mixing, compacting, and finishing can be completed during the same working day.

1 Dry Placement. Before applying cement, bring the prepared roadway to approximately optimum moisture content. When necessary, sprinkle in accordance with Item 204, "Sprinkling." Distribute the required quantity of dry cement with approved equipment. Minimize dust and scattering of cement by wind. Do not apply cement when wind conditions, in the opinion of the Engineer, cause blowing cement to become dangerous to traffic or objectionable to adjacent property owners.

2 Slurry Placement. Mix the required quantity of cement with water, as approved. Provide slurry free of objectionable materials and with a uniform consistency that can be easily applied. Agitate the slurry continuously. Apply slurry within 2 hours of adding water and when the roadway is at a moisture content drier than optimum. Distribute slurry uniformly by making successive passes over a measured section of the roadway until the specified cement content is reached

C. Mixing. Thoroughly mix the material and cement using approved equipment. Mix until a homogeneous mixture is obtained. Sprinkle the treated materials during the mixing operation, as directed, to maintain optimum mixing moisture. Spread and shape the completed mixture in a uniform layer. After mixing, the Engineer will sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the gradation requirements in Table 1.

Table 1. Gradation Requirements Minimum % Passing

SIEVE SIZE	BASE	SUBGRADE
1-3/4 in.	100	100
3/4 in.	85	85
No. 4	--	60

1
0
0

6
0

D. Compaction. Compact the mixture in one lift using density control unless otherwise shown on the plans. Complete compaction within 2 hours after the application of cement. Sprinkle or aerate the treated material in accordance with Item 204, "Sprinkling," to adjust the moisture content during compaction so that it is within 2.0 percentage points of optimum as determined by Tex-120-E. Determine the moisture content of the mixture at the beginning and during compaction in accordance with Tex-103-E. Adjust operations as required. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least one-half the width of the roller unit. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 MPH, as directed. Remove areas that lose required stability, compaction, or finish. Replace with cement-treated mixture at the Contractor's expense.

1. Ordinary Compaction. Roll with approved compaction equipment, as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.

2. Density Control. Compact to at least 95% of the maximum density determined in accordance with Tex-120-E. The Engineer will determine roadway density in accordance with Test Method Tex-115-E and will verify strength in accordance with Tex-120-E. Remove material that does not meet density requirements. Remove areas that lose required stability, compaction, or finish. Replace with cement-treated mixture and compact and test in accordance with density control methods. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

E. Finishing. Immediately after completing compaction, clip, skin, or tight-blade the surface of the cement treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Roll the clipped surface immediately with a pneumatic-tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines and grades shown on the plans or as directed. Finish grade of constructed subgrade in accordance with Section 132.3.F.I, "Grade Tolerances." Finish grade of constructed base in accordance with Section 247.4.D, "Finishing." Do not surface patch.

F. Curing. Cure for at least 3 days by sprinkling in accordance with Item 204,"Sprinkling," or by applying an asphalt material at the rate of 0.05 to 0.20 gal. per square yard, as shown on the plans or directed. Maintain the moisture content during curing at no lower than 2 percentage points below optimum. Do not allow equipment on the finished course during curing except as required for sprinkling, unless otherwise approved. Continue curing until placing another course or opening the finished section to traffic.

5. Measurement.

A. Cement. Cement will be measured by the ton (dry weight). When cement is furnished in

trucks, the weight of cement will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."

When cement is furnished in bags, indicate the manufacturer's certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer's certified weight.

Cement slurry will be measured by the ton (dry weight) of the cement used to prepare the slurry at the job site or from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

B. Cement Treatment. Cement treatment will be measured by the square yard of surface area. The dimensions for determining the surface area are established by the widths shown on the plans and lengths measured at placement.

6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement" will be paid m accordance with Section 5.A, "Cement," or Section 5.B, "Cement Treatment."

Furnishing and delivering new base will be paid for in accordance with Item 247.6.B, “Flexible Base (Roadway Delivery)." Mixing, spreading, blading, shaping, compacting, and finishing new or existing base material will be paid for under Section 6.B, "Cement Treatment." Removal and disposal of existing asphalt concrete pavement will be paid for in accordance with pertinent Items of Article 4.2, "Changes in the Work."

Sprinkling, rolling, and necessary proof-rolling, will not be paid for directly but will be subsidiary to this Item, unless otherwise shown all the plans.

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade or existing base will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade or existing base will be in accordance with pertinent Items or Article 4.2, "Changes in the Work."

Asphalt used solely for curing will not be paid for directly, but will be subsidiary to this Item. Asphalt placed for the purpose of curing and priming will be paid for under Item 310, "Prime Coat."

A. Cement. Cement will be paid for at the unit price bid for "Cement." This price is full compensation for materials, delivery, equipment, labor, tools, and incidentals.

B. Cement Treatment. Cement treatment will be paid for at the unit price bid for "Cement Treatment (Existing Material)," "Cement Treatment (New Base)," or "Cement Treatment (Full Depth Reclamation)," for the depth specified. No additional payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, providing cement, spreading, applying cement, compacting, finishing, curing, curing materials, blading, shaping and

maintaining shape, replacing mixture, disposing of loosened materials, Processing, hauling, preparing secondary subgrade, water, equipment, labor, tools, and incidentals.

Portland Cement Concrete Pavement:

(A) Description: This section regulates pavements composed of Portland cement concrete, constructed on a prepared subgrade in conformance with these standards and specifications, and in close conformance with the lines, grades, thickness, and typical cross-sections shown on the approved engineering plans, or as subsequently approved by the Director of Public Works.

(B) Materials:

(1) Concrete: In general, ready-mixed concrete meeting the requirements of ASTM Specification C94, "Specifications for ready-mixed concrete" shall have the following:

Cement	520 pound (5½ bag) minimum
Water/Cement Ratio	5.5 gallons per 94 lb. sack of cement
Air Content	6.5 % (±1.5 %) by volume

Fine Aggregate No less than 35% nor more than 45% of the total weight of the aggregate in each cubic yard.

Coarse Aggregate ¾ inch, 1 inch, or 1½ inch maximum, but not greater than 1/4 the depth of the slab.

Slump No less than 1¼ inches nor more than 3 inches for machine placed concrete. No less than 2 inches nor more than 4 inches for hand placed concrete.

Compressive Strength	7 day	-- 3,000 psi minimum
	28 day	-- 4,000 psi minimum

An admixture to produce the required rate of hardening at various temperatures may be required by the Director of Public Works under the following circumstances:

Over 80 degrees F	Type D water-reducing admixture
Between 40 and 80 degrees F	Type A water-reducing admixture

Under 40 degrees F Additional cement and/or calcium chloride. Calcium Chloride, if used, shall not exceed one (1) percent by weight of the cement and shall meet the requirements of ASTM Specification D98.

(2) Steel: Tiebars, where used, shall be deformed and shall meet the requirements of ASTM Specifications A15 (billet steel) or A16 (rail steel), except that rail steel shall not be used for tiebars that are to be bent and re-straightened during construction.

(3) Joint Material: In general, preformed fillers or inserts shall meet the requirements of ASTM Specifications D1751 or D1752. Preformed fillers or inserts shall be of rectangular X-section and non-corrodible and shall be furnished in a single piece for the full length of each joint, unless otherwise approved by the Director of Public Works.

(4) Curing Material: Material for curing concrete shall meet the requirements of the following specifications:

Liquid Membrane-Forming Compound	ASTM C309
Waterproof Paper	ASTM C171
Polyethylene Sheeting	ASTM C171
Burlap Cloth	AASHO M182
Cotton Mats	AASHO M73

(C) Mixing and Hauling: Ready-mixed concrete shall meet the requirements of ASTM Specification C94, "Specifications for Ready-Mixed Concrete." The concrete plant shall have a current "Certificate of Conformance for Concrete Production Facilities," issued by the National Ready-Mixed Concrete Association.

(D) Forming:

(1) Setting Forms: The subgrade or base under the forms shall be compacted and cut to grade so that the forms, when set, will be at the required elevation. Forms shall be of such cross-section and strength, and so secured, as to resist the pressure of the concrete when placed, and the impact and vibration of any equipment which they support, without springing or settlement. The method of connection between the sections shall be such that the joints shall not move in any direction. The maximum deviation of the top surface shall not exceed 1/8 inch in ten (10) feet, or the inside face not more than 1/4 inch in ten (10) feet from a straight line. The contractor shall check and correct alignment and grade elevations of the forms immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be re-set and re-checked. Forms shall be capable of being removed without excessive damage to the concrete pavement.

(2) Slipform Paving: As an alternative to using fixed forms, a slipform paver may be used, providing the surface of the pavement does not exceed the required tolerance. If any traffic is allowed to use the prepared subgrade or base, the subgrade or base shall be checked and corrected immediately ahead of placing the concrete.

(E) Placing, Finishing, and Texturing:

(1) Placing: The concrete shall be deposited on the subgrade or base so as to require as little rehandling as possible. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the plastic concrete with boots or shoes coated with earth or foreign substances. Placing shall be continuous between transverse joints without the use of intermediate bulkheads.

(2) Strike-Off, Consolidation, Finishing, and Texturing: The sequence of operations shall be the strike-off and consolidation, joint forming and floating, straight edging, and texturing.

(a) The pavement shall be struck off and consolidated with a mechanical finishing machine, vibrating screed, or hand finishing methods when approved by the Director of Public Works. A slipform paver may also be used.

(b) The concrete shall be adequately consolidated; however, vibrators shall not be operated longer than ten (10) seconds in any one location.

(c) After the pavement has been struck off and consolidated, and joints formed, it shall be scraped with a ten (10) foot long straight-edge having a handle to permit operation from the edge of the pavement. Any excess water and latence shall be removed from the surface of the pavement. The straight-edge shall be operated at ninety (90) degrees to the transverse joints and shall be moved forward one-half of its length after each pass. Irregularities shall be corrected by adding or removing concrete. All disturbed places shall again be straight-edged. The use of wood floats shall be kept to a minimum; they may only be used in areas not accessible to finishing equipment and for compacting concrete in the vicinity of formed joints.

(d) In general, adding water to the surface of the concrete to assist in finishing operations shall not be permitted. If the Director of Public Works should permit it, it shall be applied as a fog

spray with approved spray equipment.

(e) A burlap bag or broom shall be used for texturing. If a burlap drag is used, it shall be at least three (3) feet wide, and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the pavement surface and dragged in the direction in which the pavement is being placed. If a broom is used, brooming shall generally be parallel to transverse joints if these are formed, and at ninety (90) degrees to the direction of paving if transverse joints are sawed.

(f) Before texturing is completed, and before the concrete has taken its initial set, the slab, curb, and formed joints shall be finished with an edger, as reflected on the approved engineering plans.

(F) Curing: Concrete shall be cured by protecting it against loss of moisture, rapid temperature change, and mechanical injury for at least three (3) days after placement. White liquid membrane-forming compound, waterproof paper, white polyethylene sheeting, moist curing, or a combination of these, as reflected on the approved engineering plans, may be used.

(1) Generally, white liquid membrane-forming compound shall be used, and it shall be applied to the pavement surface immediately after the completion of the texturing operation. The compound shall also be applied to the pavement edges immediately after the forms have been removed. An application rate of one (1) gallon per two hundred (200) square feet shall be used.

(2) The compound shall be kept agitated to prevent the pigment from settling.

(3) The contractor shall have the equipment needed for adequate curing available before commencing concrete placement.

(G) Pavement Protection: The contractor shall be responsible for concrete placed during rain or low temperatures. Any concrete damaged by rain or low temperatures shall be removed and replaced at the contractor's expense.

(H) Joints: Contraction joints, expansion joints, and longitudinal joints shall be placed as indicated on the approved engineering plans. Transverse construction joints shall be used as required. Transverse joints shall extend continuously through the pavement and curb. Longitudinal joints are those joints parallel to the construction lane.

(1) Transverse Contraction Joints: Transverse contraction joints shall consist of weakened planes made by forming or sawing grooves in the surface of the pavement. They shall be equal to at least one fourth the depth of the slab.

(a) Formed transverse contraction joints shall be made by:

(i) Installing an approved insert in the plastic concrete. The insert shall be installed at ninety (90) degrees to, and within 1/8 inch of the pavement surface, or

(ii) Depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place until the concrete has attained its initial set, and then shall be removed without disturbing the adjacent concrete.

(b) Sawed transverse contraction joints shall be made by sawing grooves having a 1/4 inch maximum width in the surface of the pavement. After each joint is sawed, the adjacent concrete surface shall be cleaned. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling.

(c) All joints shall be sawed before uncontrolled shrinkage cracking occurs. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. A standby saw shall be available in the event of a breakdown. The sawing of any joint shall be omitted if a crack

occurs at or near the joint location before the time of sawing. In general, all joints shall be sawed in sequence. All contraction joints in lanes adjacent to previously constructed lanes shall be sawed before uncontrolled cracking occurs. If extreme conditions make it impractical to prevent erratic cracking by timely sawing, contraction joints shall be formed before initial set of the concrete as provided above.

(d) The length between transverse contraction joints shall not exceed fifteen (15) feet, and in no case shall be less than ten (10) feet. Transverse contraction joints shall be placed at every catch basin, inlet, or manhole in the line of pavement.

(2) Transverse Construction Joints: Transverse construction joints shall be used only when approved by the Director of Public Works whenever the placing of concrete is suspended and initial set may occur.

(3) Expansion Joints: The preformed joint filler shall be held in a vertical position. An approved installing bar or other device shall be used to ensure proper grade and alignment during placing and finishing of the concrete. Finished joints shall not deviate in horizontal alignment more than one-quarter (1/4) inch from a straight line. If preformed joint fillers are assembled in sections, there shall be no off-sets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

(4) Longitudinal Hinge Joints: Longitudinal hinge joints shall consist of weakened planes made by forming or sawing grooves in the surface of pavement, equal to at least one-third of the depth of the slab.

(a) Formed longitudinal hinge joints shall be made in the same manner as formed transverse contraction joints (see Section 2.08(H)(1) above).

(b) Sawed longitudinal hinge joints having a 1/4 inch maximum width shall be made by sawing grooves after the concrete has hardened. In general, the joint shall be sawed before use by any construction traffic or before opening, if construction traffic does not use the pavement.

(c) Whenever the width between forms of pavement under construction is greater than thirteen and one-half (13.5) feet, longitudinal joints shall be constructed so as to divide the pavement into strips.

(I) Testing:

(1) Air Testing: The air content shall be measured by the pressure method or by the volumetric method. One air content determination shall be made for each one hundred (100) cubic yards of concrete placed, or upon the direction of the Director of Public Works, to ensure the required air content is obtained; however, in no case shall less than two (2) checks be made daily.

(2) Test Specimens: The contractor shall furnish the concrete necessary for casting test cylinders. An independent testing laboratory designated by the contractor and approved by the Director of Public Works shall fabricate and test specimens. The results shall be reported to the Director of Public Works.

(3) Pavement Thickness: Before final acceptance of the pavement, its thickness shall be determined by coring at intervals not less than one hundred (100) lineal feet in each pavement lane. The length of a core shall be determined to the nearest 0.1 inch in accordance with ASTM Specification C174.

(a) When the measurement of the core is deficient in thickness by more than 0.25 inch, but not more than 1.0 inch from the required thickness, two (2) additional cores will be taken from the area represented. The additional cores will be taken at a distance of twenty-five (25) feet from the original core to determine the affected area.

(b) If the measurement of any core is less than the specified thickness by more than 1.0 inch, the actual thickness of the pavement in this area will be determined by taking exploratory cores at ten

(10) foot intervals parallel to the centerline in each direction from the affected location until a core is found which is not deficient by more than 1.0 inch. In determining the area deficient in thickness more than 1.0 inch, each exploratory core shall represent an area having a length of ten (10) feet and a width equal to the lane or average pour width.

(c) Pavement deficient in thickness more than 1.0 inch from the specified thickness shall be removed and replaced at the contractor's expense. Areas found to be deficient by more than 0.25 inch, but less than 1.0 inch shall be evaluated by the Director of Public Works. If, in his judgment, the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness shown on the approved engineering plans at the contractor's expense.

(d) The cost of the coring will be borne by the contractor.

(J) Surface Tolerance: The finished surface of the pavement shall be tested for smoothness by use of a ten (10) foot long straight-edge placed parallel to the centerline of the pavement in each wheel lane. Ordinates measured from the face of the straight-edge to the surface of the pavement shall at no place exceed 1/4 inch. Areas that do not meet the required surface accuracy shall be clearly marked out, and the contractor shall:

(1) Grind down any areas higher than 1/4 inch but not higher than 1/2 inch above the correct surface.

(2) Correct any areas lower than 1/4 inch, but not lower than 1/2 inch below the correct surface by grinding down the adjacent high areas.

(3) When the deviation exceeds 1/2 inch from the correct surface, the pavement slab shall be broken out and replaced for a length, width, and depth which will allow the formation of a new slab of the required quality in no way inferior to the adjacent undisturbed pavement.

(K) Opening to Traffic: The Director of Public Works shall decide when the pavement is to be opened to traffic. In general, the pavement shall not be opened to traffic, including construction traffic, but with the exception of sawing equipment, until seven (7) days after the placing of the concrete, or until the compressive strength of job-site cured six (6) inch by twelve (12) inch cylinders (ASTM Specification C31) averages three thousand (3,000) psi, whichever is longer.

(L) Specification: Except as they may be otherwise superseded by these standards and specifications, the specifications for the preparation and construction of Portland cement concrete pavement shall conform to the requirements of the following sub-sections of the Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges(1993 edition):

Division III, Surface Courses or Pavement

Item 360 Concrete Pavement
Item 361 Full-Depth Repair of Existing Concrete Pavement
Item 368 Terminal Anchorage Lugs (Concrete Pavement)

Division IV, Structures

Item 420 Concrete Structures
Item 421 Portland Cement Concrete
Item 433 Joints, Sealants, and Fillers
Item 437 Concrete Admixtures
Item 440 Reinforcing Steel

Division V, Incidental Construction

Item 526 Membrane Curing

CONSTRUCTION PLANS