

**SECTION 4  
PAVING SECTION**



**SUBSECTION 4.01  
UTILITY CONSTRUCTION IN CITY OF AMARILLO  
RIGHT-OF-WAY AND EASEMENTS**

**I. SCOPE**

This item contains the required methods and materials for utility construction in streets, alleys, easements, and other public right-of-ways. This item applies to excavations, trenches, and restorations for utility extensions, connections, conduit placement, utility repair, and other utility construction.

In the remaining portions of this subsection, Contractor is used to describe the independent Contractor, the City Department, or utility company franchised by the City of Amarillo that is performing the particular utility construction.

**II. MATERIAL**

**A. Backfill:**

1. Excavated material from the utility installation without any debris, used concrete, lumber of other foreign material.
2. Sand with proper gradation and no foreign material.
3. Other approved granular material.
4. Controlled Low Strength Material (Flowable Fill).

**B. Portland Cement Concrete:** Concrete shall conform to Subsection 4.09 "Concrete Separate Curb and Gutter, Sidewalks, Driveways, Valleys, Alley Aprons, Medians, Islands and Alleys."

**C. Flexible Base:** Flexible base shall conform to Subsection 4.05 "Flexible Base".

**D. Asphaltic Concrete (hot-mix):** Asphaltic Concrete shall conform to Subsection 4.13 "Hot-Mix Asphaltic Concrete."

**E. Asphaltic Concrete (cold-mix):** The pertinent sections of the TxDOT Standard Specification on Hot-Mix Cold Laid Asphaltic Concrete shall apply. The Street Superintendent shall approve the mix design for this material. Asphaltic concrete (cold-mix) shall be used only for temporary repair and not for a final surface.

**F. Joint Material:** The joint material shall conform to ASTM D 3405 Joints Sealants, Hot-Poured, for Concrete and Asphalt Pavements.

**III. EQUIPMENT**

The Contractor shall provide the appropriate equipment to perform the traffic control, site preparation, utility, concrete, flexible base, asphaltic concrete, and other pavement operations.

#### IV. CONSTRUCTION REQUIREMENTS

**A. Pavement Excavation Permit:** Prior to a Contractor, City Department, or utility franchised by the City cutting, boring, breaking, blasting, excavating, or making any hole, opening, ditch, displacement, depression or impairment in any dedicated public Right-of-way or easement, an application for an excavation permit must be made to the Street Superintendent. The permit requires repair and restoration of the right-of-way in accordance with these specifications. No work shall begin until the written permit is delivered to the Contractor. In case of emergencies, excavations shall be reported to the Street Superintendent and the permit process started within twenty-four (24) hours or the next working day after the excavation has been made. If the required construction is being done according to three party private paving agreements, no permit is required. The Contractor, a party to a private paving agreement, shall notify the Street Superintendent of the project location(s).

Applicable sections of Chapter 4-6, Platting and Subdivision Improvement and Maintenance of the Amarillo Municipal Code shall apply also.

#### **B. Time Limits and Other Requirements by Location:**

##### **1. Alleys:**

**a. Paved surface:** The trench shall be backfilled within three (3) calendar days of completion of the utility work.

The concrete for the trench cap shall be placed within seven (7) calendar days of trench backfill being complete. Ambient temperature during concrete trench cap placement shall be above forty degrees (40°) F. and concrete compressive strength shall be more than three thousand (3000) pounds per square inch in seven (7) calendar days.

The final surface shall be placed within seven (7) calendar days of the trench cap being placed. Asphaltic concrete (hot-mix) may be placed when the air temperature is above forty degrees (40°) F. and expected to rise above fifty degrees (50°) F. for at least four (4) hours and the temperature of the underlying surface is above forty degrees (40°) F.

**b. Improved surface:** The trench shall be backfilled within three (3) calendar days of completion of the utility work.

The designated material for the trench cap shall be placed within seven (7) calendar days of trench backfill being complete.

The designated material for the final surface shall be placed within seven (7) calendar days of trench cap being placed.

**c. Natural surface:** The trench shall be backfilled within three (3) calendar days of completion of utility work. The top eight (8) inches of the backfill shall be at least equal in composition and density to the adjacent native material.

##### **2. Residential Streets:**

**a. Paved surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work.

The concrete for the trench cap shall be placed within five (5) calendar days of trench backfill being complete. Ambient temperature during concrete trench cap placement shall

be above thirty-five degrees (35°) F. and concrete compressive strength shall be more than three thousand (3000) pounds per square inch in five (5) calendar days.

The final surface shall be placed within seven (7) calendar days of trench cap being placed. Asphaltic concrete (hot-mix) may be placed when the air temperature is above thirty-five degrees (35°) F. and expected to rise above forty-five degrees (45°) F. for at least four (4) hours and the temperature of the underlying surface is above thirty-two degrees (32°) F.

**b. Improved surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work.

The designated material for the trench cap shall be placed within five (5) calendar days of trench backfill being complete.

The designated material for the final surface shall be placed within seven (7) calendar days of trench cap being placed.

**c. Natural surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work. The top eight (8) inches of the backfill shall be at least equal in composition and density to the adjacent native material.

### 3. Collector Streets:

**a. Paved surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work.

The concrete for the trench cap shall be placed within three (3) calendar days of trench backfill being complete. Ambient temperature during concrete trench cap placement must be above thirty-two degrees (32°) F. and concrete compressive strength shall be more than three thousand (3000) pounds per square inch in three (3) calendar days.

The final surface shall be placed within five (5) calendar days of trench cap being placed. Asphaltic concrete (hot-mix) may be placed when the air temperature is above thirty-five degrees (35°) F. and expected to rise above forty-five degrees (45°) F. for at least four (4) hours and the temperature of the underlying surface is above thirty-two degrees (32°) F.

**b. Improved surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work.

The designated material for the trench cap shall be placed within five (5) calendar days of trench backfill being complete.

The designated material for the final surface shall be placed within seven (7) calendar days of trench cap being placed.

**c. Natural surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work. The top eight (8) inches of the backfill shall be at least equal in composition and density to the adjacent native material.

### 4. Arterial Streets:

**a. Paved surface:** The trench shall be backfilled within twenty-four (24) hours of completion of utility work.

The trench cap shall be placed within two (2) calendar days of trench backfill being complete. Ambient temperature during concrete trench cap placement must be above thirty-two degrees (32°) F. and concrete compressive strength shall be more than three thousand (3000) pounds per square inch in two (2) calendar days.

The final surface shall be placed within four (4) calendar days of trench cap being placed. Asphaltic concrete (hot-mix) may be placed when the air temperature is above thirty-two degrees (32°) F. and expected to rise above forty degrees (40°) F. for at least four (4) hours and the temperature of the underlying surface is above thirty-two degrees (32°) F.

**b. Improved surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work.

The designated material for the trench cap shall be placed within three (3) calendar days of trench backfill being complete.

The designated material for the final surface shall be placed within five (5) calendar days of trench cap being placed.

**c. Natural surface:** The trench shall be backfilled within two (2) calendar days of completion of utility work. The top eight (8) inches of the backfill shall be constructed at least equal in composition and density to the adjacent native material.

**5. Easements and Other Public Right-of-ways:** The type of existing surfaces and amount of vehicular traffic shall be the factors for the Street Superintendent to determine what time limits are required.

**6. Other Requirements:** The construction time limits for excavation, backfill, and paving restoration are applicable to individual segments such as a city block of a new subdivision, a capital improvement project, or an isolated utility installation.

Any asphaltic or Portland cement concrete placed during weather conditions that does not meet these specifications whether inadvertently or as directed on an emergency basis by the Street Superintendent shall be removed and properly replaced during acceptable weather conditions. The required trench cap may be constructed of compacted flexible base of a greater depth during temporary pavement restoration.

Any street or alley with utility construction shall be properly barricaded and opened to vehicular traffic with an adequate traffic control system in place until the repair is completed as approved by the Street Superintendent.

All final surfaces shall remain to grade for one year from project acceptance. The Contractor shall correct any settlement which occurs during the maintenance warranty period.

**7. Exceptions:** When the utility installation includes participation by any City of Amarillo Department, the time limits shall be set on a project by project basis. The Street Superintendent and the respective City of Amarillo Department representative shall determine the time limits.

#### **C. Existing Pavement Removal:**

**1. Asphaltic Concrete Removal:** Prior to removal, a smooth vertical joint shall be cut full depth and completely around the area to be removed. The joint shall be made with an acceptable tool. The pavement shall be cut back in a straight line at least six (6) inches

from the furthestmost point of excavation, shearing, caving, or removal of any other cause on each side of the ditch.

**2. Portland Cement Concrete Removal:** Prior to removal, a vertical joint shall be neatly cut completely around the area to be removed. The pavement shall be cut back in a straight line at least six (6) inches from the furthestmost point of excavation, shearing, caving, or removal of any other cause on each side of the ditch. The cut shall be deep enough to insure a smooth joint when the concrete is removed.

**3. Brick Removal:** The brick shall be properly removed and stored at City of Amarillo designated locations if not replaced on the project site.

**4. Paver Removal:** The pavers shall be properly removed and stored at City of Amarillo designated locations if not replaced on the project site.

**D. Utility Trench Excavation:** The Contractor shall provide equipment and shoring materials to proceed without interruption and prevent damage to existing facilities. Pipe, cable, conduit and other carriers shall be installed to prevent traffic interruption.

Excavated material shall be properly handled and temporarily stored without undue effect on adjacent property or the right-of-way.

Where utility excavation is near adjacent facilities and structures, the Contractor shall support and protect such facilities. When services, poles, guy wires, pipe lines or other obstructions are to be moved, the Contractor shall cooperate with the utility owner. When existing structures or utilities are damaged during construction, the Contractor shall restore the facilities to their original condition.

The maximum allowable trench width shall be the pipe outside diameter plus twenty-four (24) inches. The trench walls shall be vertical, unless other excavation methods are approved prior to start of work.

**E. Utility Installation:** The Contractor shall provide equipment, labor and material as required by the appropriate utility company or City of Amarillo Department and its specifications for the proper installation.

**F. Utility Trench Backfilling:** Backfilling shall be accomplished by one of the following methods. The Street Superintendent shall approve what backfilling method shall be used prior to any project construction. The Contractor or appropriate City of Amarillo Department project representative shall contact the Street Superintendent prior to construction or design.

1. Excavated or imported material shall be placed in the trench in uniform layers of eight (8) inches or less. Each layer shall be compacted to the adjacent undisturbed soil density.

2. Excavated or imported material shall be placed in the trench completely and water jetted until trench settlement is complete.

3. Sand shall be placed in the trench in uniform layers of eight (8) inches or less and properly compacted.

4. Sand shall be placed in the trench and water jetted until trench settlement is complete.

5. Controlled Low Strength Material may be placed in the trench. The typical CLSM mix design shall consist of water, Portland Cement, Fly Ash, and Fine Aggregate in accordance with American Concrete Institute specifications.

6. Other backfill material and methods as specified on individual utility projects and as approved by the Street Superintendent prior to use.

**G. Pavement Restoration:** Where existing pavement is cut for any utility installation, it shall be cut in a straight line at least six (6) inches from the furthest point of excavation, shearing, caving, or removal of any other cause on all sides of the construction. The excavation shall be thoroughly compacted to original subgrade. A six (6) inch thick concrete cap shall be installed on the compacted backfill spanning the excavation by at least six (6) inches on each side. Concrete for the cap shall meet the appropriate specifications. Concrete compressive strengths for the shorter time to completion requirements may be obtained by adding calcium chloride to the original mix design, substituting Type I/II cement with Type III cement or substituting the concrete with an acceptable rapid concrete repair material such as Pyrament 505. One course of 6X6 No. 6 welded wire fabric shall be placed one (1) inch above the bottom of the cap for the entire area. The cap shall be overlaid with the designated material for the final surface.

When a utility trench width is excessive or under special project circumstances, the compacted backfill may be overlaid with eight (8) inches of compacted flexible base. This substitution of the flexible base for the trench cap shall be approved by the Street Superintendent and the project representative. The flexible base shall be overlaid with the designated material for the final surface.

When controlled low strength material is used in the utility trench, the concrete trench cap may be deleted by the Street Superintendent.

The utility trench with the cap shall be overlaid with at least two (2) inches of asphaltic concrete (hot-mix). The final surface shall match and not have any abrupt elevation differences with the adjacent existing pavement surface. On projects with other final surface material, the material depth and width, and construction methods shall be as determined by the Street Superintendent.

Where natural or improved surface right-of-ways are scheduled for pavement by three party agreements or capital improvement projects, the appropriate paved surface specifications apply. The approved type of backfill material and its installation method for the utility excavation shall determine if a concrete trench cap is required. No final surface may be placed until the Street Superintendent or his representative has approved the utility excavation backfill and intermediate surface.

The joint between the new asphaltic concrete and the existing pavement shall be filled with a compatible joint sealing material.

The ambient air temperature requirements during concrete (asphaltic and portland) placement shall not prevent any temporary repairs as needed in unusual situations and weather conditions. When the wind chill factor effectively reduces the ambient air temperature more than fifteen degrees, permanent surface restoration construction shall cease and the utility cut properly barricaded until weather conditions improve. If weather conditions continue to be unacceptable for an extended period, temporary surface restoration shall be done. Conditions requiring temporary repairs shall be as determined by the Street Superintendent.

The trench cap shall be maintained until the final surface is placed. The utility Contractor, utility company, and utility cut Contractor shall determine who is responsible for the trench cap prior to trench excavation. Any adjacent pavement failure attributable to the trench cap allowing to be exposed too long shall be repaired by the Contractor at his expense.

**H. Surface Restoration Other Than Pavement:**

**1. Natural surface restoration:** Where the natural surface was soil, sod, ground cover, decorative vegetation, or other landscape improvements, the Contractor shall replace the material to its original condition before project acceptance. Natural surface restoration in vehicle traveled locations is using the existing soil to restore the right-of-way to its original condition.

**2. Improved surface restoration:** Where the improved surface was sidewalk, paving stones, driveway, or other improved surface, the Contractor shall replace the surface to its original condition before project acceptance. Improved surface restoration in vehicle traveled locations uses the existing stabilized material, flexible base or gravel to restore the right-of-way to its previous condition.

**I. Construction Inspection:** The Street Superintendent or his authorized representative shall inspect all pavement related work for utility construction in City of Amarillo right-of-way and/or easements.

**J. Other Utility Placement Methods:** The Street Superintendent or his authorized representative shall approve any tunneling, boring, or jacking method in any City of Amarillo right-of-ways or easements prior to the Contractor beginning work.

Mud formed in boring operations shall be used to fill voids around any pipe or casing in a bored excavation.

All pits or trenches needed to facilitate this work shall be excavated outside the traveled portions of the right-of-way. All pits or trenches shall be backfilled immediately after the pipe is in place.

**K. Contractor Construction Responsibility:** All pavement, curb and gutter, sidewalk, driveways, foliage, fences or other property improvement broken or damaged during construction whether within the work area, adjacent right-of-way, or private property shall be removed and replaced by the Contractor at his expense. In replacing damaged concrete, the Contractor shall tie to the next full and complete joint. The replaced pavement, concrete trench cap, and flexible base shall conform to these specifications. The Contractor shall maintain all surfaces until final acceptance. All paving repairs which fail during the one year warranty period shall be replaced at the Contractor's expense.

The Contractor shall maintain the pavement restoration from initial backfill through final paving. When temporary repairs are required by the Street Superintendent, the Contractor shall furnish and place the appropriate material to backfill the utility cut. When temporary repairs are furnished by the Street Department, the Contractor shall be charged for the services and material provided.

**L. Contractor Traffic Control Responsibility:** The Contractor shall have an approved traffic control plan for each project. The Contractor shall furnish, place, erect, and maintain flashing lights, barricades, construction signs, and other required traffic safety devices for protection of public and private property at the project site. The cost of all traffic control plan maintenance by the City of Amarillo shall be reimbursed by the Contractor.

The Contractor must request through the Street Superintendent that the Traffic Engineer close any street for construction. After approval the Contractor shall notify all the City Departments involved. The Contractor shall also notify all emergency services when the street will be closed and when it will be opened. The Contractor shall request permission from the Street Superintendent to deviate from the announced street closing times.

All proposed detours shall be approved by the Traffic Engineer prior to any construction. The Contractor may request the Traffic Engineering Department to design the detour. If the detour includes any dirt or improved surface streets, the Contractor shall provide proper dust control and passable surfaces during inclement weather. The Contractor shall maintain the detours to the satisfaction of the Street Superintendent.

The Contractor shall furnish adequate traffic control measures for utility construction when traffic must be allowed on remaining portions of the street. This is most applicable on arterial streets when only one-half of the street may be blocked for utility installation.

#### **V. MEASUREMENT**

If the utility construction is a part of a capital improvement project for the City of Amarillo, the particular bid documents and their specifications shall determine the work to be measured for payment.

If the utility construction is part of franchised utility improvements, the work will not be measured for payment.

If the utility construction is a City of Amarillo improvement project, the work will not be measured for payment.

#### **VI. PAYMENT**

If measured for payment, the construction shall be paid for at the specified unit price provided by the Contractor in his proposal.

**LAST PAGE OF THIS SUBSECTION**

**SUBSECTION 4.02  
EARTHWORK****I. SCOPE**

This item includes the required excavation within the project limits, placement and compaction of approved earth materials for embankment, the removal and disposal of all excavated materials not required, and the shaping and finishing of all subgrade and in conformity with the required lines, grades, and cross sections.

**II. MATERIALS**

Excavated materials shall be used where possible within project limits.

**III. EQUIPMENT**

**A. General:** Unless otherwise provided, the Contractor shall furnish all machinery, tools, equipment, and qualified equipment operators for the proper prosecution and completion of the work.

All equipment shall be maintained in good repair and operating condition and shall be approved by the Engineer prior to use.

**B. Earthwork Equipment:**

1. **Motor Graders:** Motor graders shall be self-propelled with dual or four-wheel drive; shall be equipped with pneumatic tires; shall have a blade of not less than twelve (12) feet in length; and shall have a wheel base of not less than sixteen (16) feet. A scarifier of an approved type shall be provided.

2. **Scrapers:** Each scraper shall have not less than eight (8) cubic yards capacity and shall be self-propelled. Each scraper shall be capable of self-loading to full capacity or additional necessary power equipment shall be provided to push or pull each scraper to load to full capacity.

3. **Tractors:** Each tractor shall have a bulldozer attachment. Where a heavy duty scarifier or ripper is needed, such attachments designed for operation with the required tractor shall also be furnished. The tractor shall be either of the crawler type or rubber-tired tractor and have adequate tractive effort. The bulldozer attachment shall have a blade of not less than eight (8) feet in length.

**C. Compaction Equipment:**

1. **General:** Suitable and sufficient compacting equipment shall be provided to obtain the required densities and stabilities complete compaction of embankment and subgrade. Compaction equipment shall obtain the required densities and stabilities.

**2. Tamping Rollers:**

a. **Light:** The light tamping roller shall consist of two metal rollers, drums, or shells of forty (40) inches minimum diameter; each not less than forty-two (42) inches in length and unit-mounted in a rigid frame in such manner that each roller may oscillate independently of the other; and each roller, drum, or shell shall be surmounted by metal studs with tamping feet projecting not less than seven (7) inches from the surface and spaced not less than six (6) inches nor more than ten (10) inches measured diagonally center to center;

and the cross-sectional area of each tamping foot, measured perpendicularly to the axis of the stud, shall be not less than five (5) nor more than eight (8) square inches. The roller shall be supplemented with cleaning teeth to provide self cleaning. The roller shall be so designed that by ballast loading, the load on each tamping foot may be varied uniformly from one hundred twenty-five (125) to not less than one hundred seventy-five (175) pounds per square inch of cross-sectional area. The load per tamping foot will be determined by dividing the total weight of the roller by the number of tamping feet in one row parallel to or approximately parallel to the axis of the roller. The tamping roller shall be self propelled.

**b. Heavy:** The heavy tamping roller shall consist of two or three metal drums, rolls, or shells of sixty (60) inches minimum diameter. If the two-drum type is furnished, each drum shall be not less than sixty (60) inches in length. If the three-drum type is furnished, the roller shall consist of two forward drums and one rear drum, the drums to be so arranged that the rear drum will compact the space between the two forward rolls, and rollers of this type shall have an overall width of not less than ten (10) feet.

The drums shall be unit-mounted in a rigid frame in such manner that each drum may oscillate independently of the other.

Each drum shall be surmounted by metal studs with tamping feet projecting not less than seven (7) inches from the surface and shall be so spaced as to result in one tamping foot for each 0.65 to 0.7 square foot of drum area. The area of each tamping foot shall be approximately seven (7) square inches, but shall be not less than six (6) nor more than eight (8) square inches. All rollers shall be provided with cleaning teeth so designed and attached as to prevent the accumulation of material between the tamping feet.

The roller shall be so designed that by ballast loading, the load on each tamping foot may be varied to five hundred fifty pounds per square inch (550 psi) of cross-sectional area.

### **3. Pneumatic Tire Rollers:**

**a. Light:** The light pneumatic tire roller shall consist of not less than nine pneumatic tired wheels, running on axles where the rear group of tires will cover the entire gap between adjacent tires of the forward group, and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle. The pneumatic tire roller shall have an effective rolling width of approximately sixty (60) inches and shall be so designed that by ballast loading, the total load may be varied uniformly from nine thousand (9,000) pounds to eighteen thousand (18,000) pounds. The roller shall be equipped with tires that will afford ground contact pressures to forty-five (45) pounds per square inch or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart. The roller shall provide a uniform compression under all wheels. The light pneumatic tire roller shall be self-propelled.

**b. Medium:** The medium pneumatic tire roller shall consist of not less than seven pneumatic tired wheels, running on axles where the rear group of tires will cover the entire gap between adjacent tires of the forward group, and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle. The pneumatic tire roller shall have an effective rolling width of approximately eighty-four (84) inches and shall be so designed that by ballast loading the total load may be varied uniformly from twenty-three thousand five hundred (23,500) pounds to fifty thousand (50,000) pounds. The roller shall be equipped with tires that will afford ground contact pressures to eighty pounds (80) per square inch or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart.

The medium pneumatic tire roller shall be self-propelled. The power unit shall have adequate tractive effort to properly move the operating roller at variable uniform speeds up to approximately five (5) miles per hour.

c. **Heavy:** The heavy pneumatic tire roller shall consist of not less than four pneumatic tire wheels, running on axles carrying not more than two wheels, and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces.

The roller shall have a rolling width from eight (8) feet to ten (10) feet. By ballast loading, the gross load may be varied uniformly from twenty-five (25) tons to fifty (50) tons. The tires shall be capable of operating under the various loads with variable air pressure up to one hundred fifty (150) pounds per square inch. The operating load and tire air pressure shall be within the range of the manufacturer's chart. The heavy pneumatic tire roller shall be self-propelled.

There shall be a sufficient quantity of ballast available to load the equipment to a maximum gross weight of fifty (50) tons.

4. **Flat Wheel Rollers:** Power rollers shall be the three-wheel or tandem, self-propelled type, weighing not less than required to obtain densities and stabilities.

D. **Alternative Equipment:** In lieu of the compaction equipment specified, the Contractor may operate other compacting equipment that will provide compaction in the same period of time as the specified equipment. If the alternative equipment fails to produce compaction within the same time period as the specified equipment, its use shall be discontinued.

#### IV. CONSTRUCTION METHODS

A. **Excavation:** The Contractor shall excavate and fill to the lines and grades as shown on the plans. All construction stakes set by the Engineering Department shall be maintained by the Contractor.

All excavated materials must be disposed of at the Contractor's expense. Should additional material be required for proper grade, the Contractor shall furnish and place same.

All rock, flexible paving, bushes, shrubs, trees, and other material not designated by a bid item in the project proposal shall be removed by the Contractor at the unit price bid for earthwork, or excavation and subgrade, or other similar bid item. Excavation will be unclassified. The Contractor is expected to satisfy himself as to the nature of the excavation expected.

B. **Embankment:** Prior to placing any embankment, all clearing operations shall have been completed. Clearing operations will consist of the removal and disposal of tree stumps, brush, roots, vegetation, logs, rubbish, and other objectionable materials. Stump holes or other small excavation shall be backfilled with suitable material and thoroughly tamped by approved methods. The surface of the ground, including plowed, loosened ground, or surface roughened by small washes or otherwise, shall be restored to approximately its original slope by blading or other approved methods and where indicated on plans.

Where embankments are to be placed adjacent to or over existing subgrade, the existing subgrade shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible layer depth. After completion of the earthwork portion, it shall be continuously maintained to its finished section and grade until the project is accepted.

All embankment materials shall be approved by the Engineer.

Earth embankments shall be constructed in successive layers for the full width of the cross section and in such length as are suited to the sprinkling and compaction methods utilized. Prior to compaction, the layers shall not exceed six (6) inches in depth where pneumatic tire rolling is to be used and shall not exceed eight (8) inches in depth for rolling with other types of rollers. Layers of embankment may be formed by utilizing scrapers or by other acceptable methods.

Each layer of embankment shall be uniform as to material and moisture content before beginning compaction. Where layers of unlike materials abut each other, each layer shall be featheredged for at least one hundred (100) feet or the material shall be so mixed as to prevent abrupt changes in the compacted soil. Clods or lumps of material shall be broken and the embankment material mixed by blading, harrowing, or similar methods. Water required for sprinkling to bring the material to the optimum moisture content plus or minus two (2) percent necessary for compaction shall be evenly applied. The Contractor shall secure a uniform moisture content throughout the layer necessary methods. Each layer shall be compacted by rolling until ninety five (95) percent of the specific material's Standard Proctor is obtained.

**C. Concrete Removal and Disposal:** Concrete pavement, curbs, gutters, valleys, alley aprons, sidewalks, and driveways shall be removed to neatly sawed edges with saw cuts made to a minimum depth of one and one-half (1 1/2) inches. Saw cuts are to be made as shown on the plans. The Contractor may remove to a scored or construction joint further away from the designated saw cut with the additional slab removal and replacement at his expense.

When the concrete slab is cracked or broken other than along the saw cut, the additional concrete removal and replacement will not be any additional cost to the City.

**D. Subgrade Preparation:** Subgrade whether in a cut or fill shall be scarified at least six (6) inches deep. All unstable or otherwise objectionable material shall be removed and replaced with approved material. All holes, ruts, and depressions shall be filled with approved material. The subgrade shall be thoroughly wetted, reshaped, and rolled to place the subgrade in an acceptable condition to receive the next course and/or curb and gutter. The subgrade shall be finished to line and grade shown on the plans, and any deviation in excess of one-half (1/2) inch shall be corrected by loosening, adding, or removing material, reshaping and compacting to ninety five (95) percent of the subgrade material Standard Proctor density. Water required to bring the material to the optimum moisture content or plus or minus two (2) percent shall be evenly applied. Sufficient subgrade shall be prepared in advance of other operations.

**E. Utilities:** The Contractor shall determine the location of all utilities within the project and shall use every precaution in protecting them. The Contractor shall work around, protect, and repair, if damaged any utility lines. The Contractor shall notify the respective utility in sufficient time so that they may remove, lower, replace, and/or do any other adjustment to their facilities and/or properties.

**F. Protection of Private or Public Property:** The Contractor shall use every precaution possible for the protection of all property. Exclusive of other properties mentioned herein to be protected, it is the Contractor's responsibility to protect trees, plants, grass, shrubbery, drainage structures, and any or all other properties in or near the project. The Contractor is responsible for all damage due to his work incurred to any or all properties.

**G. Clean Up and Backfill:** Where the existing ground elevation is higher than the top of curb elevation, the embankment shall be cut back on the slopes shown on the plans.

Where the existing ground elevation is lower than the top of curb elevation, the space behind the curb shall be backfilled on a maximum slope of six to one from the top of curb unless otherwise shown on the plans.

**H. Disposal of Excess Material:** Excess materials excavated shall be disposed of properly by the Contractor. Contractor shall use top soil in the backfill behind the curbs. The Contractor shall not dispose of any material in any "Flood Hazard Area" within the City limits or its extraterritorial jurisdiction. The Contractor shall be familiar with "Flood Hazard Areas" limits.

## V. MEASUREMENT

The work shall be measured either by the square yard of surface of area or by the cubic yard of excavation. Measurement by either method will be calculated as shown on the plans. The method also will be shown by item and unit measure in the project proposal.

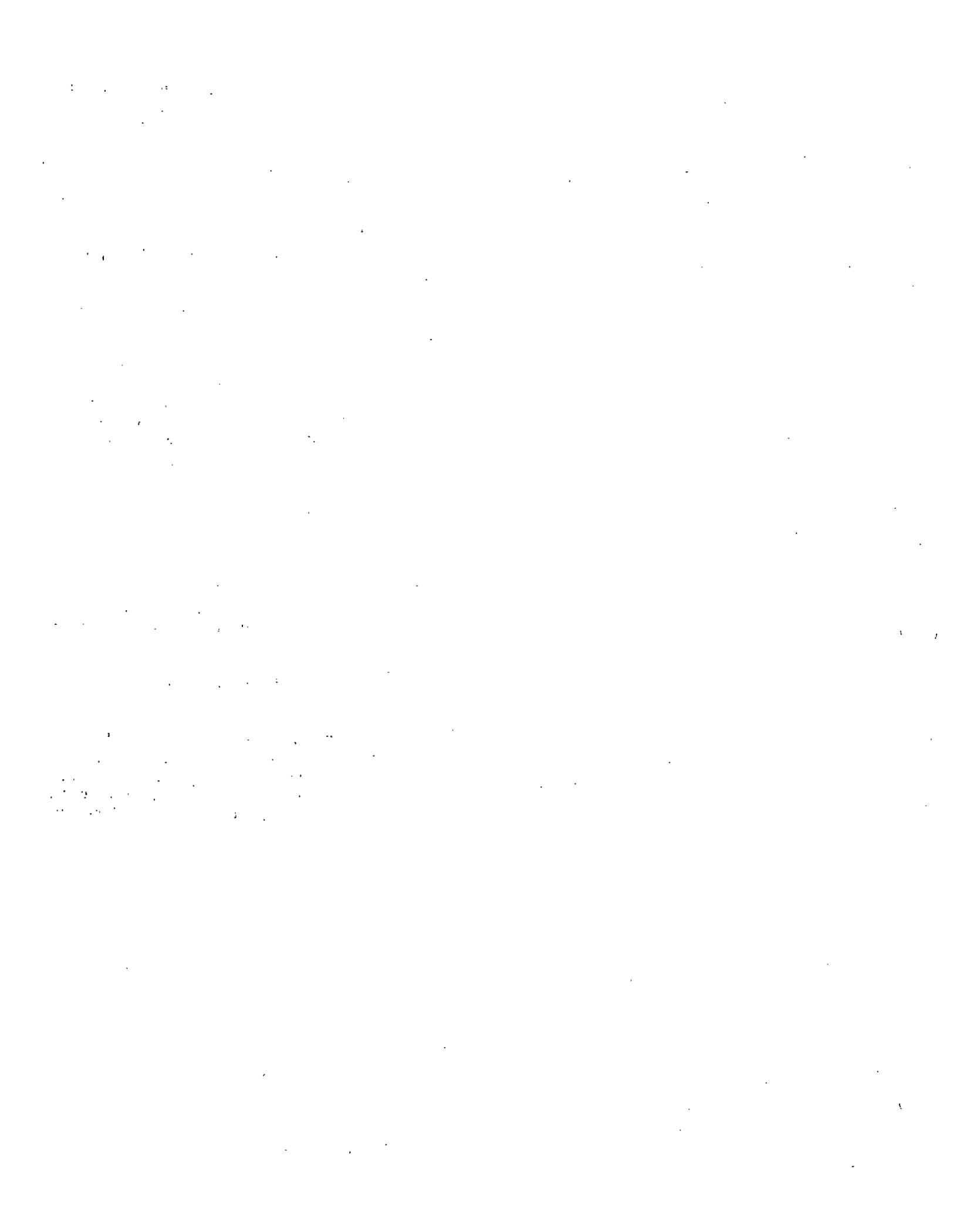
Trees over six (6) inches in diameter will be measured for payment if required to be removed. All shrubbery, brush, and smaller diameter trees will not be measured for payment, but shall be considered subsidiary to appropriate earthwork item.

## VI. PAYMENT

In the square yard measurement method, the unit price shall be full compensation for excavating, hauling, compacting, shaping, fine grading, wetting, rolling, removal of trees, shrubs and existing pavement, and all other work required in the excavation and embankment operation.

In the cubic yard measurement method, the appropriate excavation and embankment items will be in the proposal.

The work performed and material furnished shall be paid for at the unit price bid for the appropriate bid item. This unit price shall be full compensation for securing and furnishing all materials involved; for all processing required; for loading, hauling, delivering, placing, and spreading for blading, shaping, and compacting to the specified grade; and for all manipulation, labor, tools, and incidentals necessary to complete the work.



**SUBSECTION 4.03  
LIME-FLY ASH (LFA) AND FLY ASH (FA) TREATMENT  
FOR MATERIALS IN PLACE**

**I. SCOPE**

This item includes treating the subgrade, subbase or base by pulverizing, adding lime-fly ash or fly ash, mixing and compacting the resultant mixture to the required density. This item applies to one or more layers of soil, existing processed pavement, subbase, or base modified with water, lime-fly ash or fly ash. Each layer shall conform with the lines, grades, thicknesses, and typical cross sections shown on the plans.

**II. MATERIALS**

**A. GENERAL:** Fly ash shall meet ASTM Specification C-618 when sampled and tested unless otherwise shown on the plans.

Hydrated lime is quicklime with water added to satisfy its chemical affinity. This material consists essentially of calcium hydroxide or a mixture of calcium hydroxide and magnesium oxide and magnesium hydroxide.

**B. Hydrated Lime Chemical Composition:** Hydrated lime for stabilization purposes shall conform to the following chemical composition requirements:

Total alkalinity of an as-received sample, calculated as % by weight, of CaO, minimum . . . . .	72.0
Loss on ignition of an as-received sample, 3 hours @ 2,000° F., % by weight, minimum . . . . .	23.0
maximum . . . . .	26.5
Carbon dioxide content of an as-received sample, calculated as % by weight of CO <sup>2</sup> , maximum . . . . .	5.0

**C. Residue:** The percentage residue of hydrated lime for stabilization purposes shall conform to the following requirements:

Residue retained on No. 30 (590-micron) sieve, % by weight, maximum . . . . .	1.0
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**D. Bituminous Material:** Bituminous material shall meet the requirements of bituminous material in Item 300 "Asphalts, Oils and Emulsions" of the TxDOT.

When tested by TxDOT Test Methods, the various stabilization and curing materials shall meet the applicable requirements of this specification.

**E. Water:** Water shall be reasonably clean and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Potable Water may be used without being treated. If the water is questionable, it shall be tested in accordance with AASHTO T 26.

### III. EQUIPMENT

**A. Storage Equipment:** Hydrated lime and fly ash shall be stored and handled in closed, weather-proofed containers until immediately before distribution. If storage bins are used, they shall be completely enclosed. Materials in bags shall be stored in weatherproof buildings with adequate protection from ground dampness.

**B. Water Sprinklers:** The sprinklers shall be equipped with positive and rapidly working cut-off valves and approved spray bars and shall be designed, equipped, and operated so as to ensure the distribution of water in a uniform and controllable rate of application. The water shall be applied in the required quantity.

**C. Mixing Equipment:**

1. **Harrows:** Harrows shall be of the offset disc-harrow type with twenty-two (22) inch discs and not less than ten (10) feet in width.

2. **Rotary Mixers:** The rotary mixer shall be of the Soil Stabilizer (Heavy Duty) type approved by the Engineer. In all cases, the final mix shall be made with a rotary mixer or its equal.

**D. Weather Limitations:** The stabilized mixture shall not be constructed while the atmospheric temperature is below forty degrees (40°) F. or when conditions indicate that the temperature may fall below forty degrees (40°) F. prior to completion of the operation. The operation shall not be started when weather conditions are foggy or rainy, or when soil or subgrade is frozen.

### IV. CONSTRUCTION METHODS

**A. General:** A completed stabilized subgrade, subbase, or base containing a uniform lime-fly ash or fly ash mixture free from loose or segregated areas, of uniform density, and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses shall be constructed. The Contractor shall regulate his work sequence to process a sufficient quantity of material to provide full depth as shown on the plans with proper amounts of lime, if required, and fly ash; maintain the work; and rework the courses as necessary.

**B. Preparation:** The previous course shall be graded and shaped as required to construct the lime-fly ash or fly ash treatment for materials in place in conformance with the lines, grades, thickness, and typical cross section shown on plans. All unsuitable soils or material shall be removed and replaced with acceptable material.

The subgrade, subbase, or base shall be firm and support without displacement, the construction equipment. Soft or yielding subgrade shall be made stable by scarifying, adding lime and/or fly ash, and compacting until it is uniformly stable with a density no less than ninety five (95) percent of Standard Proctor for the stabilized subgrade.

**C. Pulverization:** The material to be stabilized shall be pulverized until one hundred (100) percent by weight shall pass a one (1) inch sieve and eighty (80) percent shall pass a No. 4 sieve, exclusive of gravel or stone retained on the No. 4 sieve.

If the Contractor elects to use a cutting and pulverizing machine that will remove the material accurately to undisturbed soil or previous course and pulverize the material at the same time, he will not be required to expose the subgrade nor windrow the material. However, the Contractor shall be required to correct any soft areas in the subgrade or previous course. This method will be permitted only when a machine uniformly cuts to the

proper depth and whose cutters will plane the lower surface over the entire width of the cut. The machine must give visible indication at all times that it is cutting to the proper depth.

**D. Application and Mixing:** Mixing of the material, lime or fly ash, and water shall be by the mix-in-place or the central-plant-mixed method. The moisture percentage of the material shall permit a uniform and homogeneous mixture of material and lime or fly ash during mixing operations. Moisture content shall not be two (2) percent below the optimum moisture content for the stabilized material.

**1. Applying and Mixing in Place:** Stabilization material, either lime, fly ash, or a combination of both, in the percentage required shall be spread by an approved method over an area only as large as mixing operations can be completed during the same work day. Any stabilization material that has been displaced shall be replaced before mixing is started. After the stabilization material has been applied, it shall be mixed with the material. Mixing shall continue until the stabilization material has been sufficiently blended with the material to form a homogeneous mixture.

When both lime and fly ash are to be used, the Contractor shall apply the material largest percent material first, dry mix in, apply the second material, and thoroughly mix all the materials.

Immediately after the material and stabilization material(s) have been mixed, water shall be incorporated into the mixture. Excessive amounts of water on or near the surface shall be avoided. A water supply and pressure distributing equipment shall be provided that will assure the application within three (3) hours. After all mixing water has been applied, mixing shall continue until a uniform and homogeneous mixture of material, stabilization material(s), and water has been obtained.

**2. Central Plant Mixing and Spreading:** The material, stabilization material(s), and water shall be mixed in a pugmill, either of the batch or continuous flow type. The plant shall be equipped with feeding and metering devices which will add the material, stabilization material(s), and water into the mixer in the specified quantities. Material and stabilization material(s) shall be mixed sufficiently. Mixing shall continue until a uniform and homogeneous mixture of material, stabilization material(s), and water is obtained.

The mixture shall be hauled to the project in trucks equipped with protective covers. The mixture shall be placed on the moistened subgrade or previous course in a uniform layer by approved spreaders. Not more than thirty (30) minutes shall elapse between the placement of stabilized material(s) in adjacent lanes.

The stabilized material shall be uniform in thickness and surface, and of sufficient quantity to conform to the required grades and typical section. Dumping of the mixture in piles or windrows upon the subgrade or previous course will not be permitted.

Not more than sixty (60) minutes shall elapse between the start of moisture mixing and the start of compaction of the mixture.

**E. Compaction:** The moisture percent in the mixture shall not be below or more than two (2) percent above the optimum moisture content and shall not cause the final mixture to become unstable during compaction and finishing. Moisture content and density of the mixture shall be determined by AASHTO T 134 test from the area being compacted.

Prior to compaction, the mixture shall be in a loose condition for its full depth. The loose mixture shall be uniformly compacted to the specified density within two (2) hours. Shaping may be required to obtain uniform compaction and required grade and cross

section. The in place density for stabilized subgrade or subbase shall not be less than ninety five (95) percent of the final mixture's Standard Proctor. The in place density for stabilized base shall not be less than one hundred (100) percent of the final mixture's Standard Proctor.

Subgrade and final mixture testing is the responsibility of the City of Amarillo.

**F. Finishing:** During and after compaction, the surface of the mixture shall be shaped to the required lines, grades, and cross section. Scarifying may be used to remove any tire imprints or smooth surface imperfections left by equipment. The resulting surface shall then be compacted to the specified density to obtain a dense smooth surface that is free from compaction planes, cracks, ridges, or loose material.

The surface of the mixture shall be maintained at optimum moisture content during the finishing operation. Any portion of the mixture that varies substantially from the specified density shall be removed and replaced by the Contractor.

**G. Construction Joints:** At the end of each days run, a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true transverse vertical face. The construction joints may be protected by the placing, spreading, and compacting of stabilized material without injury to the work previously laid. Care shall be exercised to ensure thorough compaction of the stabilized material immediately adjacent to all construction joints. When it is necessary to operate and/or turn any equipment on the completed stabilized course, sufficient protection and cover shall be provided to prevent damage to the finished surface.

**H. Protection and Curing:** After the stabilized material has been finished, it shall be protected against drying for a period of no less than three (3) days or until the next paving course is placed by applying bituminous material or maintaining the surface in a thorough and continuously moist condition. The curing method shall begin as soon as possible, but no later than six (6) hours after finishing. If bituminous material for curing is elected by the Contractor, the finished stabilized material shall be kept moist continuously until the curing material is placed.

The bituminous curing material shall be uniformly applied at an acceptable rate to the stabilized material. The curing material shall be maintained and applied as needed by the Contractor during the three (3) day protection period.

When the air temperature may fall below thirty-five degrees (35°) F., sufficient protection from freezing shall be given the stabilized material.

The bituminous covered surface shall be protected with sufficient granular cover shall be applied to prevent pick up. If heavy or by heavy construction equipment working on adjoining project sections use the section, the stabilized material shall be properly protected as directed by the Project Representative.

**I. Construction Limitations:** The Contractor shall modify construction procedures when any phase is interrupted for more than thirty (30) minutes or the uncompacted mixture is out of the moisture content tolerances. All material designated to be reconstructed shall be at the Contractor's expense.

**J. Surface Tests:** The finished surface shall not vary more than three-eighths (3/8) of an inch when tested with a sixteen (16) foot straight edge applied parallel with, or at right angles to, the longitudinal axis of the pavement. Any variations in excess of this tolerance shall be corrected by the Contractor.

**K. Thickness:** The thickness of the stabilized material shall be determined by the measurements of cores drilled at a spacing to represent not more than two hundred (200) square yards. The average thickness of the stabilized material shall be within one-fourth (1/4) of an inch of the thickness shown on the plans, and the thickness at any one point shall not vary more than one-half (1/2) of an inch from plans. If too thin, the stabilized material shall be removed and replaced by the Contractor without additional compensation. If too thick, the Contractor will only be paid for quantities of planned thickness.

**L. Maintenance:** The Contractor shall be required to maintain the entire stabilized material satisfactorily. Maintenance shall include immediate repairs of any defects that may occur either before or after the stabilization material is applied. The work shall be repeated as often as necessary to keep the area intact at all times. Repairs shall be made in a manner that will ensure restoration of a uniform surface and the durability of the part repaired. Faulty work must be replaced for the full depth of the treatment. Any thin areas shall be remedied by replacing the material for the full depth of the treatment rather than by the addition of a thin layer of stabilized material to a completed surface.

## **V. MEASUREMENT**

**A. Stabilized Subgrade, Subbase, or Base:** The stabilized material shall be measured in square yards of completed and accepted finished surface.

**B. Fly Ash:** The amount of fly ash shall be measured by the ton installed.

**C. Lime:** The amount of lime shall be measured by the ton of lime installed.

## **VI. PAYMENT**

**A. Stabilized Subgrade, Subbase, or Base:** Payment shall be made at the contract unit price per square yard for stabilized material. This price shall be full compensation for furnishing all materials, all preparation, delivering, placing, and mixing of these materials, except for the stabilization material used, and for all labor, equipment, tools and incidentals necessary to complete this portion of the project.

**B. Fly Ash:** Payment shall be made at the contract unit price per ton of fly ash for the calculated amount for planned thickness. This price shall be full compensation for furnishing this material and for all delivery, placing, and incorporation of this material, and for all labor, equipment, tools, and incidentals necessary to complete the work.

**C. Lime:** Payment shall be made at the contract unit price per ton of lime for the calculated amount for planned thickness. This price shall be full compensation for furnishing this material and for all delivery, placing, and incorporation of this material, and for all labor, equipment, tools, and incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION



**SUBSECTION 4.04  
LIME STABILIZED SUBGRADE**

**I. SCOPE**

This item includes stabilizing the subgrade by mixing lime with the subgrade material and compacting the mixed material. The stabilized subgrade shall be constructed in accordance with the plans and to the lines and grades as established by the Engineer.

**II. MATERIALS**

The general, chemical composition, and residue requirements of Subsection 4.03 "Lime-Fly Ash (LFA) and Fly Ash (FA) Treatment For Materials In Place" shall apply.

**III. EQUIPMENT**

The storage equipment, water sprinklers, and mixing equipment requirements of Subsection 4.03 "Lime-Fly Ash (LFA) and Fly Ash (FA) Treatment For Materials In Place" shall apply.

**IV. CONSTRUCTION METHODS**

**A. General:** A complete lime stabilized subgrade containing a uniform lime mixture free from loose or segregated areas, of uniform density and moisture content, well bound from top to bottom, and with a smooth hard surface is required.

Prior to beginning any stabilization, all topsoil within the subgrade limits to a depth of four (4) inches shall be removed. The subgrade shall be brought to line and grade by approved methods.

The Contractor shall regulate his work sequence, maintain the subgrade, or re-work the subgrade as necessary to meet the requirements.

**B. Application of Slurry Mix and Mixing:** The introduction of the lime to the subgrade material shall be done in a manner approved by the Engineer. Procedures and equipment shall change if satisfactory results are not being obtained. The required amount of lime shall be as shown on the project plans and the appropriate bid item in the proposal.

The lime shall be incorporated into the subgrade material as follows: The lime shall be mixed with water in tanks or trucks with approved distributors and applied as a thin water suspension or slurry. Dry mixing is allowed only in extremely small areas where slurry mixing is impractical. The lime required shall be distributed by successive passes over a determined section of subgrade. The ratio of the lime to water in the slurry shall be determined to prevent the moisture content of the subgrade-lime mixture exceeding optimum moisture by more than two (2) percent.

The distributor truck or slurry tank shall be equipped to keep the hydrated lime and water in a consistent mixture until application.

Lime for subgrade stabilization shall not be mixed or placed when the subgrade is frozen or when the air temperature is below fifty degrees (50°) F. and falling. Lime for stabilization shall be mixed and/or placed only when weather conditions are suitable to the Project Representative. Lime stabilization is to be mixed only with a rotary-type tiller or mixer.

The completed subgrade mixture shall be compacted immediately behind the mixing operation.

Lime shall be applied only to such an area that all the operations can be completed during the same working day.

No surface material shall be placed on the completed stabilized subgrade within three (3) days after the final rolling. The curing time may be reduced if, in the opinion of the Engineer, the subgrade has adequately cured.

During the curing time, the subgrade shall be kept moist by sprinkling or covered with a bituminous membrane seal.

Hydrated lime that has been exposed to open air for a period of six (6) hours or more, or to moisture for any length of time, will not be accepted for payment.

**C. Compaction:** Compaction of the mixture shall begin immediately after mixing. The material shall be aerated or sprinkled as necessary to provide the optimum moisture. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted to required density. When the rolling develops irregularities that exceed one-half (1/2) of an inch when tested with a sixteen (16) foot straightedge, the irregular surface shall be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required by these provisions. Along places inaccessible to roller, the material shall be tamped thoroughly with mechanical or hand tampers.

The "Density Control" method of compaction for stabilized subgrade shall apply as follows: The bottom course shall be sprinkled as required and compacted to the extent necessary to provide not less than ninety-five (95) percent of the Standard Proctor density for the stabilized material. All other subsequent courses under this item shall be compacted to a minimum of ninety-eight (98) percent.

Test Method TxDOT-114-E or other approved methods will be used. In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests as necessary will be made by the Engineer. If the material fails to meet the density requirements, it shall be re-worked 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 section shown on the plans and to the established lines and grades. Should the stabilized material due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished.

## V. MEASUREMENT

Lime stabilized subgrade shall be measured by the square yard to neat lines shown on the plans. Lime shall be measured by the ton. For each load of dry lime placed in the slurry tank, or truck, a weight ticket from an approved weighing station showing the net weight of each load shall be given to the Project Representative. The Contractor may provide at the project site a set of approved standard platform truck scales.

## VI. PAYMENT

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid per ton for lime and at the unit price bid per square yard for lime stabilized subgrade, which prices shall be full compensation for furnishing all labor, materials, tools, equipment, for loosening, mixing and pulverizing, spreading, shaping, all hauling and freight involved, and all incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION

**SUBSECTION 4.05  
FLEXIBLE BASE**

**I. SCOPE**

This item includes a foundation course for an asphaltic concrete surface course or other base courses; shall be composed of either caliche, crushed stone, gravel, or other material approved by the Engineer, and shall be constructed as herein specified in one or more courses in conformity with the typical sections shown on plans and to the lines and grades as established by the Engineer.

**II. MATERIALS**

**A. Material Requirements, Sampling and Testing**

**1. Material Requirements:** The materials shall be crushed or uncrushed as necessary to meet the requirements specified and shall consist of durable coarse aggregate particles mixed with approved binding materials. The contractor shall furnish uncontaminated materials of uniform quality that meet all of the requirements of the plans and specifications.

**2. Material Acceptance:** The materials shall be approved by the Engineer at the source prior to the start of construction. The Engineer shall be notified of the proposed material source and shall be made aware of any change to the material source throughout the duration of the project. Acceptance testing for material approval shall be performed at the Contractor's pit or stockpile location, prior to the materials being delivered to the project. The Contractor shall furnish test results no older than one year from project bid date.

**3. Material Sampling:** The Engineer may sample and test project materials for quality control at any time, before compaction, throughout the duration of the project to assure specification compliance. Sampling may occur at the pit location, the stockpile or the roadway as long as the sample is obtained before compaction. All material samples shall be obtained by the testing laboratory personnel from uncompacted material and in a manner independent of the contractor's operations. Under no circumstances shall the contractor directly provide material samples to a testing laboratory for Engineer requested tests.

**4. Material Rejection:** The materials that fail to meet any test standard or requirement as specified in the plans and specifications shall be considered rejected. This material will be removed from the project site and replaced with satisfactory materials at the discretion of the Engineer.

**B. Types of Flexible Base:**

**1. Type F:** Type F material shall consist of argillaceous limestone, calcareous or calcareous clay particles, with or without stone, conglomerate, gravel, sand, or other granular materials. All the acceptable material shall be screened, and the oversize shall be crushed and returned to the screened material again in such manner that a uniform product will be produced.

**a. Grade 1:** When tested by TxDOT standard laboratory methods, the base material shall meet the following requirements:

Passing 1 3/4" sieve	100%
Retained on No. 4 sieve	45 to 75%
Retained on No. 40 sieve	50 to 85%

Material passing the No. 40 sieve shall be known as "Soil Binder" and shall meet the following requirements when prepared in accordance with TxDOT Test Method TxDOT-101-E procedure:

The liquid limit shall not exceed	35
The plasticity index shall not exceed	12
The bar linear shrinkage shall not exceed	2%
The wet ball mill value shall not exceed	45

The material shall be a Class 2 or higher in quality as determined in TxDOT 117-E, Triaxial Compression Tests for Base Materials.

b. **Grade 2:** The grading, soil constants and/or Triaxial requirements and other specification data for Type F Grade 2 base material shall be as shown on the plans.

2. **Type B:** Type B material shall consist of durable particles of gravel mixed with approved binding material. The binder may be added and incorporated by approved methods as herein specified. All the acceptable material shall be screened, and the oversize shall be crushed and returned to the screened material again in such manner that a uniform product will be produced.

a. **Grade 1:** When properly slaked and tested by TxDOT standard laboratory methods, the base material shall meet the following requirements:

Retained on 1 3/4" sieve	0%
Retained on 3/8" sieve	20 to 60%
Retained on No. 4 sieve	40 to 75%
Retained on No. 40 sieve	65 to 85%

Material passing the No. 40 sieve shall be known as "Soil Binder" and shall meet the following requirements when prepared in accordance with Test Method TxDOT-101-E procedure:

The liquid limit shall not exceed	35
The plasticity index shall not exceed	12
The wet ball mill value shall not exceed	50

The material shall be a Class 2 or higher as determined in TxDOT 117-E, Triaxial Compression Tests for Base Materials.

b. **Grade 2:** The grading, soil constants and/or Triaxial requirements and other specifications data for Type B Grade 2 base material shall be as shown on the plans.

3. **Type A:** Type A material shall be crushed and shall consist of durable particles of stone mixed with approved binding material.

a. **Grade 1:** When properly slaked and tested by TxDOT standard laboratory methods, the flexible base material shall meet the following requirements:

Retained on 1 3/4" sieve	0%
Retained on No. 4 sieve	45 to 75%
Retained on No. 40 sieve	60 to 85%

Material passing the No. 40 sieve shall be known as "Soil Binder" and shall meet the following requirements when prepared in accordance with Test Method TxDOT-101-E procedure:

The liquid limit shall not exceed	35
The plasticity index shall not exceed	12
The wet ball mill value shall not exceed	50

The material shall be a Class 2 or higher as determined in TxDOT 117-E, Triaxial Compression Tests for Base Materials.

**b. Grade 2:** The grading, soil constants and/or Triaxial requirements and other specification data for type A Grade 2 base material shall be as shown on the plans.

**4. Type FA:** Type FA material shall consist of processed fly ash. The material shall be approved by the Engineer at the source. All the acceptable material shall be screened, and the oversize shall be crushed and returned to the screened material again in such manner that a uniform product will be produced. Testing the material shall be done prior to the compaction operations. The Contractor shall furnish test results no older than one year from project bid date. The City will make such independent tests as necessary while the stockpile is being produced to determine that the material is acceptable.

**a. Grade 1:** When tested by TxDOT standard laboratory methods, the base material shall meet the following requirements:

Passing 1 3/4" sieve	100%
Retained on No. 4 sieve	45 to 75%
Retained on No. 40 sieve	60 to 85%

Material passing the No. 40 sieve shall be known as "Soil Binder" and shall meet the following requirements when prepared in accordance with TxDOT Test Method TxDOT-101-E procedure:

The liquid limit shall not exceed	35
The plasticity index shall not exceed	12
The bar linear shrinkage shall not exceed	2%
The wet ball mill value shall not exceed	45

The material shall be a Class 2 or higher as determined in TxDOT 117-E, Triaxial Compression Tests for Base Materials.

**b. Grade 2:** The grading, soil constants and/or Triaxial requirements and other specification data for Type FA Grade 2 base material shall be as shown on the plans.

**5. Type S:** Type S material shall consist of salvaged base material within the project limits. The Contractor shall receive explicit permission from the project inspector prior to using this material unless otherwise required by particular bid items. The existing base material must primarily be one of the preceding types of base materials. Any oversize material remaining from a pulverization process shall be crushed and returned to the salvaged material again in such manner that a uniform product will be produced. The Contractor shall furnish test results prior to any Type S material being allowed to be incorporated into the project. The City will take samples for independent testing as necessary from the salvaged material stockpile.

**a. Grade 1:** When tested by TxDOT standard laboratory methods, the salvage base material shall meet the following requirements:

Passing 1 3/4" sieve	100%
Retained on No. 40 sieve	50 to 85%

Material passing the No. 40 sieve shall be known as "Soil Binder" and shall meet the following requirements when prepared in accordance with TxDOT Test Method TxDOT-101-E procedure:

The liquid limit shall not exceed	35
The plasticity index shall not exceed	12
The linear shrinkage shall not exceed	8.5%
The wet ball mill value shall not exceed	50

The material shall be a Class 2 or higher as determined in TxDOT 117-E, Triaxial Compression Tests for Base Materials.

**b. Grade 2:** The grading, soil constants and/or Triaxial requirements and other specification data for Type S Grade 2 base material shall be as shown on the plans.

**C. Material Sources:** If the Contractor produces the specified type of base material from local pits, the material shall be approved by the Engineer. These pits, as utilized, shall be opened up in such a manner as to immediately expose the vertical faces of all the various strata of acceptable material, and unless otherwise directed, the material shall be secured in successive vertical cuts extending through all of the exposed strata, in order that a uniformly mixed material will be secured.

The processed material shall not be hauled directly to the project, but shall be stockpiled. The stockpile shall be made up of layers approximately one (1) foot thick or as otherwise directed by the Engineer. After a sufficient stockpile, has been constructed as specified, the Contractor may proceed with loading from the stockpile for delivery to the project. In loading from the stockpile for delivery to the project, the material shall be loaded by making **successive vertical cuts through the entire depth** of the stockpile.

The Engineer reserves the right to inspect the pit location or the stockpile at any time throughout the duration of the project to ensure compliance with all material processing and handling requirements. Any observed or documented mishandling of materials in the pit or stockpile may be cause for rejection of that source, at the discretion of the Engineer. All costs for additional sampling and acceptance testing required as a result of rejecting the material source shall be the responsibility of the Contractor.

Salvaged base material shall be first removed from its original location to an acceptable stockpile location if processing in place cannot be performed satisfactorily to the project inspector. Depending on the particular bid items in each project, the Subgrade shall be exposed to allow proper compaction and moisture content.

### III. EQUIPMENT

The equipment of Subsection 4.02 "Earthwork" shall apply.

### IV. CONSTRUCTION METHODS

**A. Subgrade Preparation:** Subsection 4.02 "Earthwork" shall apply.

Base material shall not be laid upon frozen subgrade. Curb and gutter shall be constructed and cured sufficiently prior to base material placement. The curb and gutter shall not be damaged during base material placement. The condition of the subgrade shall be approved by the Engineer prior to placing of base material.

**B. Number of Courses:** Flexible base material shall be laid and compacted in courses of equal depth of either four (4) inches, five (5) inches, or six (6) inches as follows:

Thickness of Base Material	Number of Courses
6"	one 6" course
8"	two 4" courses
10"	two 5" courses
12"	two 6" courses

For any base thickness of greater than twelve (12) inches, the courses shall be of equal thickness with no single course of a thickness less than four (4) inches nor greater than six (6) inches.

**1. First Course:** Immediately prior to placing of the base material, the subgrade shall be checked. The base material shall be delivered in approved vehicles. Base material deposited upon the subgrade shall be spread and shaped the same day. If inclement weather or other unforeseen circumstances render impractical the spreading of the base material during the first twenty-four (24) hour period, the base material shall be later scarified and spread as directed by the Engineer. The base material shall be sprinkled, bladed, processed, and shaped to conform to typical sections as shown on plans. All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded base material.

The base material shall be sprinkled as required and compacted to the extent necessary to provide not less than the one hundred (100) percent of Standard Proctor density. The moisture content shall not vary more than two (2) percent from optimum moisture content. 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. In no event will the density be less than one hundred (100) percent of Standard Proctor. 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 one-fourth (1/4) inch in cross section, and in a length of sixteen (16) feet measured longitudinally shall be corrected by loosening, adding or removing base 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 base material as required, reshaping and recompacting by sprinkling and rolling. Should the first course, due to any reason or cause, lose the required stability, density, or finish before the surfacing is complete, it shall be recompacted and refinished at the Contractor's expense.

On projects where eight (8) inches or more base material is specified, the material shall extend under the curb and gutter to the back of curb. The amount of base under the curb and gutter will be the thickness of the total base course, less six (6) inches, but in no case less than four (4) inches.

**2. Succeeding Courses:** Prior to placing the final surfacing on the completed base material, the base material surface shall be primed with a low viscosity liquid asphalt such as MC-30, MC-70 or MC-250, at an application rate of 0.20 to 0.50 gallons per square yard. The prime coat shall be allowed to penetrate the prepared surface. If the bituminous material fails to penetrate within an allowable time period and the roadway must be used by traffic, blotter material shall be spread in the amounts required to absorb the excess prime coat.

**C. Addition to Existing Flexible Base:** Any required additional base material that is to be added to an existing flexible base to conform with the typical sections shown on the plans and to the lines and grades, as established by the Engineer, shall be properly bonded to the existing base and fine graded to the proper section.

**V. MEASUREMENT**

Work and accepted material as prescribed for flexible base will be measured by one of two methods. The first method of measurement will be by a unit of surface area (square yard or as stated in the proposal) of the flexible base, in place, for a specified thickness and shall be measured from toe of gutter to toe of gutter. On projects where there is flexible base below the curb and gutter it will be measured for payment at its specified thickness. The second method of measurement will be by the compacted cubic yard in its final position as the volume of flexible base computed in place between the original subgrade or subbase surfaces and the lines, grades, and sections established by the Engineer by the method of average end areas.

**VI. PAYMENT**

The work performed and material furnished as prescribed by this item and measured as provided will be paid for at the unit price per square yard bid for "Flexible Base" of the thickness specified or by the cubic yard of "Flexible Base", complete in place.

The unit prices bid shall each be full compensation for shaping and fine grading the subgrade; for securing and furnishing all material including all royalty and freight involved; for additives, if required, for loosening, blasting, excavating, screening, crushing, and temporary stockpiling; for loading, hauling, and delivering all materials; for spreading, mixing, blading, processing, sprinkling, compacting, shaping, finishing, and priming; and for all manipulation, labor, tools, and incidentals necessary to complete the work.

**SUBSECTION 4.06  
ASPHALT STABILIZED BASE**

**I. SCOPE**

This item includes base courses or subbase courses composed of a compacted mixture of mineral aggregate and asphaltic material mixed hot in a mixing plant. The percent asphalt shall be as shown on the plans or as directed by the Engineer.

**II. MATERIALS**

**A. Asphaltic Materials:**

1. **Mixture:** Asphalt for the asphalt stabilized base mixture shall be of the types and grades of asphalt cement as determined by the Engineer.
2. **Tack Coat:** The asphalt for tack coat shall meet the requirements for emulsified asphalt. Asphaltic materials shall meet the requirements of Item 300 Asphalts, Oils, and Emulsions of the TxDOT Standard Specifications.

**B. Mineral Aggregate:**

1. **Description:** The material shall be crushed or uncrushed and screened as necessary to meet the requirements hereinafter specified and shall consist of durable coarse aggregate particles mixed with approved binding materials.
2. **Grade:** Unless otherwise specified, the mineral aggregate gradation shall conform to the following:

Material	Percent by Weight
Retained on 1 1/2" sieve . . . . .	0%
Retained on 1" sieve . . . . .	0 - 10%
Retained on 3/8" sieve . . . . .	30 - 55%
Retained on No. 4 sieve . . . . .	45 - 70%
Retained on No. 40 sieve . . . . .	70 - 85%

Unless otherwise specified on the plans, the mineral aggregate shall meet the following physical requirements:

Wet Ball Mill . . . . .	50 Max.
Plasticity Index . . . . .	10 Max.
Liquid Limit . . . . .	40 Max.
Sand Equivalent Value . . . . .	40 Min.

Samples for testing the material shall be taken prior to the mixing operations. Where more than one material is used, tests will be on the combined materials. The percent asphalt in the mixture shall be as determined by the Engineer using TxDOT mix design procedures.

**C. Material Sources:** The material source must be approved by the Engineer.

Unless otherwise specified, one or more types of mineral aggregate or binder may be used to produce the specified mixture.

**D. Asphalt Stabilized Mixture:**

1. **Paving Mixture:** The mixture shall be a uniform mixture of mineral aggregate and asphaltic material. The asphalt shall form from 4.0 to 7.0 percent of the mixture by weight unless otherwise shown on the plans.

Unless otherwise specified on plans or individual project specifications, the asphalt content will conform to the table shown on the following table:

**PERCENT ASPHALT**

<b>Material</b>	<b>Minimum</b>
Gravel base material with added coarse aggregate . . . . .	4.5%
Caliche base material . . . . .	6.0%
Caliche base material with limestone screenings . . . . .	5.0%

2. **Tolerances:** Samples of the mixture shall not vary from the asphalt content designated by the Engineer by more than 0.25 percent dry weight.

**III. EQUIPMENT**

A. **General:** Contractor shall furnish all machinery, tools, and equipment necessary for the proper prosecution and completion of the work.

All equipment shall be maintained in good repair and operating condition and shall be approved by the Project Representative prior to use.

B. Equipment as specified in Specification 4.13 "Hot-Mix Asphaltic Concrete" shall be used.

**IV. CONSTRUCTION METHODS**

A. **General:** The asphalt stabilized base shall be placed with a spreading and finishing machine and shall not be placed when the air temperature is below fifty degrees (50°) F. and falling, but it may be placed when the air temperature is above forty degrees (40°) F. and rising and is expected to rise above fifty degrees (50°) F. for a period of four (4) or more hours. The air temperature shall be taken in the shade away from artificial heat. The prime coat, tack coat, or asphalt stabilized base shall be placed only when the humidity, general weather conditions, and temperature and moisture condition of the subbase or subgrade are suitable.

If the temperature of a load of the asphalt stabilized base becomes more than thirty degrees 30° F. less than the mixing temperature prior to placing, all or any part of the load may be rejected and payment will not be made for the rejected material.

B. **Tack Coat:** Tack coat for asphalt stabilized base shall conform to tack coat as specified in Subsection 4.13 "Hot Mix Asphaltic Concrete."

C. **Transporting:** Transporting the asphaltic stabilized base shall conform to transporting as specified in Subsection 4.13 "Hot Mix Asphaltic Concrete."

**D. Placing:** Placing the asphaltic stabilized base shall conform to placing as specified in Subsection 4.13 "Hot Mix Asphaltic Concrete."

**E. Compacting:** Compacting the asphalt stabilized base shall conform to compacting as specified in Subsection 4.13 "Hot Mix Asphaltic Concrete."

**F. Rolling:** Rolling the asphalt stabilized base shall conform to rolling as specified in Subsection 4.13 "Hot Mix Asphaltic Concrete."

**G. Surface Finish:** The compacted material shall conform to the typical cross sections, lines, and grades as shown on plans and directed by the Engineer and shall have a smooth surface with a reasonably uniform texture acceptable to the Engineer. Unacceptable finished courses shall be removed and replaced.

**H. In Place Density:** Asphalt stabilized base densities shall conform to "In Place Density" as specified in Subsection 4.13 "Hot Mix Asphaltic Concrete."

#### **V. MEASUREMENT**

Work and accepted material as prescribed for asphalt stabilized base will be measured by a unit of surface area for a specified thickness.

#### **VI. PAYMENT**

The work performed and materials furnished as prescribed by this item and measured as provided will be paid for at the unit price bid for "Asphalt Stabilized Base" of the type, grade, and thickness specified. The prices shall each be full compensation for quarrying, furnishing all materials, prime coat, tack coat, all stripping, and freight involved; for all heating, mixing, hauling, shaping, and fine grading the subgrade or cleaning the existing base course or pavement, placing asphalt stabilized base, rolling and finishing; and for all manipulations, labor, tools, equipment, and incidentals necessary to complete the work.



**SUBSECTION 4.07  
LIME STABILIZED BASE**

**I. SCOPE**

This item includes base courses or subbase courses composed of a compacted mixture of lime and flexible base. The lime stabilized base shall be constructed in accordance with the plans and to the lines and grades established by the Engineer.

**II. MATERIALS**

**A. Flexible Base:** The flexible base shall conform to Subsection 4.05 "Flexible Base" of these specifications.

**B. Lime:** The general, chemical composition, and residue requirements of Subsection 4.03 "Lime-Fly Ash (LFA) and Fly Ash (FA) Treatment For Materials In Place" shall apply.

**III. EQUIPMENT**

The storage equipment, water sprinklers, and mixing equipment requirements of Subsection 4.03 "Lime-Fly Ash (LFA) and Fly Ash (FA) Treatment For Materials In Place" shall apply.

**IV. CONSTRUCTION METHODS**

**A. General:** A complete course of flexible base containing a uniform lime mixture free from loose or segregated areas, of uniform density and moisture content, well bound from top to bottom, and with a smooth hard surface shall be constructed. The Contractor shall regulate his work sequence, maintain the work, and moisture content, or rework the course as necessary to meet the above requirements.

**B. Application of Slurry Mix and Mixing:** Lime application to the base material shall be done in a manner approved by the Engineer. The required amount of lime shall be as shown on the project plans and the appropriate bid item in the proposal.

The lime shall be incorporated into the flexible base material as follows: The lime shall be mixed with water in tanks or trucks with approved distributors and applied as a thin water suspension or slurry. Dry mixing is allowed only in extremely small areas where slurry mixing is impractical. The lime required shall be distributed by successive passes over a determined section of flexible base. The ratio of the lime to water in the slurry shall be determined to prevent the moisture content of the flexible base-lime mixture exceeding optimum moisture by more than two (2) percent.

The distributor truck or slurry tank shall be equipped to keep the hydrated lime and water in a consistent mixture until application.

Lime for base stabilization shall not be mixed or placed when the subgrade is frozen or when the air temperature is below forty degrees (40°) F. Lime for stabilization shall be mixed or placed only when weather conditions are suitable. Lime stabilization is to be mixed only with a rotary type tiller or mixer.

The completed lime base mixture shall be compacted immediately behind the mixing operation. The completed stabilized base material shall be moist-cured for three (3) days. The lime slurry shall be applied only to such an area that all the operations can be completed during the same working day. No surface material shall be placed on the completed stabilized base within four (4) days after the final rolling.

Hydrated lime that has been exposed to open air for a period of six (6) hours or more, or to natural moisture for any length of time, will not be accepted for payment.

**C. Compaction:** Compaction of the mixture shall begin immediately after mixing. The mixture shall be aerated or sprinkled as necessary to provide optimum moisture. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted to the density required.

The "Density Control" method of compaction for flexible base shall apply. The bottom course shall be sprinkled as required and compacted to the extent necessary to provide not less than one hundred (100) percent of the Standard Proctor density. All other subsequent courses treated under this item shall be compacted to same requirements. Moisture content of the base shall not vary more than two (2) percent from optimum moisture content.

Testing will be in accordance with Test Method TxDOT-114-E or other approved methods. If the mixture fails to meet the density requirements, it shall be reworked as necessary. The shape of the course shall be maintained by blading; and the surface, upon completion, shall be smooth and in conformity with the typical section shown on the plans and to the established lines and grades. Should the compacted mixture, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished.

**D. Protection and Cover:** After the lime stabilized base has been finished as specified herein, it shall be protected against drying by an emulsion application. Should construction equipment or other traffic use the section before the emulsion has dried sufficiently to prevent pick-up, the Contractor shall dust or sand the surface before such use. The Contractor shall maintain this curing cover until the succeeding course is placed.

## **V. MEASUREMENT**

Lime stabilized base shall be measured by the square yard to neat lines shown on the plans. Lime shall be measured by the ton. For each load of dry lime placed the Contractor will give the Project Representative a weight ticket from an approved weighing station showing the net weight of each load. The Contractor may provide at the project site a set of approved standard platform truck scales.

## **VI. PAYMENT**

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid per ton for "lime" and at the unit price bid per square yard for "Lime Stabilized Base" which prices shall be full compensation for furnishing all labor, materials, tools, equipment, for loosening, mixing and pulverizing, spreading, shaping and maintaining, emulsion, all hauling and freight involved, and all incidentals necessary to complete the work.

**LAST PAGE OF THIS SUBSECTION**

**SUBSECTION 4.08  
CEMENT STABILIZED BASE**

**I. SCOPE**

This item includes base courses or subbase courses composed of a compacted mixture of cement and flexible base. The compacted mixture for a reconstructed base course shall be the existing flexible base, the existing asphaltic surface, additional base necessary for proposed width and base depth, Portland cement, and water. The cement stabilized base shall be constructed as specified and shall conform to the typical sections, lines and grades as shown on the plans. Existing unsatisfactory base material shall be removed or admixed with new flexible base to create an acceptable material.

**II. MATERIALS**

**A. Flexible Base:** Flexible base shall conform to Subsection 4.05 "Flexible Base".

**B. Material Sources:** Should the Contractor elect to produce the flexible base from local pits, the material shall be approved by the Engineer.

**C. Cement:** The cement shall be Type II Portland cement. Type II cement shall conform to ASTM C 150.

Bulk or sacked cement may be used, and a bag shall contain ninety-four (94) pounds net. All bags shall be in good condition at the time of inspection. Bags varying more than five (5) percent from the specified weight may be rejected, and if the average net weight in any shipment as shown by weighing fifty (50) bags taken at random is less than that specified, the entire shipment may be rejected. Bulk cement shall be weighed on approved scales as herein prescribed.

Any cement which has become partially set or which contains hard lumps or cakes, or cement salvaged from discarded or used bags, shall not be used.

**D. Water:** Water shall be reasonably clean and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Potable water may be accepted for use without being treated. If the water is questionable it shall be tested in accordance with AASHTO T 26.

**III. EQUIPMENT**

**A. General:** Cement stabilized base may be constructed with any equipment that will produce acceptable cement stabilized base.

**B. Storage Equipment:** Cement shall be stored and handled in closed, weather-proofed containers until immediately before distribution on the project. If storage bins are used, they shall be completely enclosed. Materials in bags shall be stored in weatherproof buildings with adequate protection from ground dampness. Cement shall be placed for access to identify and inspect each lot or shipment.

**C. Water Sprinklers:** The sprinklers shall be equipped with positive and rapidly working cut-off valves and approved spray bars and shall be designed, equipped, and operated so as to ensure the distribution of water in a uniform and controllable rate of application. The water shall be applied in the required quantity.

**D. Mixing Equipment:**

**1. Harrows:** Harrows shall be of the offset disc-harrow type with twenty-two (22) inch discs and not less than ten (10) feet in width.

**2. Rotary Mixers:** The rotary mixer shall be of the Soil Stabilizer (Heavy Duty) type approved by the Engineer. In all cases, the final mix shall be made with a rotary mixer or its equal.

**E. Weather Conditions:** Cement stabilized base shall not be mixed or placed when subgrade is frozen or when the air temperature is below forty degrees (40°) F. and falling. Cement stabilized base shall be mixed or placed only when weather conditions are suitable.

#### **IV. CONSTRUCTION METHODS**

**A. General:** Any existing base course to be reconstructed should have sufficient depth for stabilization. If the existing flexible base is not at least six (6) inches in depth or of sufficient width, additional approved flexible base shall be admixed to obtain the required depth. The additional flexible base will be delivered in approved vehicles to the construction site in the required quantity.

**B. Subgrade Preparation:** In the construction of a new subgrade or when necessary to remove existing flexible base and cut down the subgrade, the earthwork subsection shall apply.

**C. Existing Base Pulverizing:** The existing flexible base and any additional base material for depth and width requirement shall be pulverized. One hundred (100) percent of the cement stabilized mixture shall pass a one (1) inch sieve and a minimum of eighty (80) percent shall pass a No. 4 sieve, exclusive of any gravel or stone. Asphaltic concrete shall be pulverized so that one hundred (100) percent will pass a two (2) inch sieve.

After pulverizing the existing base material and asphaltic concrete surface, and further mixing with additional base material the resultant mixture shall be homogeneous. This pulverizing and mixing may be accomplished by blading, discing, harrowing, plowing, or other acceptable means of pulverizing and mixing.

After mixing, the base material shall be spread over the subgrade or previous course to approximate grade and crown and made ready for the cement application.

**D. Cement Application:** Portland cement shall be spread uniformly on the flexible base at the rate specified. Cement shall be applied only to such an area that all the operations can be continuous and completed in daylight within six (6) hours of such application.

The flexible base moisture content shall not exceed the only optimum moisture content for the cement stabilized base.

Only spreading and mixing equipment will be allowed to pass over the freshly spread cement.

**E. Mixing and Processing:** One of the following methods of mixing and processing shall be used by the Contractor:

**1. Multiple-Pass Travelling Mixer:** After the cement has been applied, it shall be dry-mixed with the base. Mixing shall continue until the cement has been sufficiently blended with the base to prevent the formation of cement balls when water is applied. The base and cement mixture that has not been compacted and finished shall not remain undisturbed for more than thirty (30) minutes.

Immediately after the dry mixing of base and cement is complete, water as necessary shall be uniformly applied and incorporated into the mixture. Pressurized equipment and supply provided shall be adequate to insure continuous application of the required amount of water to sections being processed within three (3) hours of application of the cement. Proper care shall be exercised to insure proper moisture distribution at all times. After the last

increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

**2. Single-Pass Travelling Mixing Plant:** After the cement has been applied, it shall be sufficiently dry-mixed with the base to prevent the formation of cement balls when water is applied. Unpulverized lumps in the cement stabilized mixture immediately behind the mixer will not be permitted.

The mixer shall be provided with means for visibly and accurately gauging the water application. The water shall be applied uniformly through a pressure spray bar.

After cement is spread, mixing operations shall proceed as follows: The mixer shall, in one continuous operation, mix the base and cement full depth, add the required water uniformly, thoroughly mix the base, cement and water, spread the completed cement stabilized mixture evenly over the machine processed width of the subgrade, and leave it in a loose condition ready for immediate compaction.

The base and cement mixture after mixing and before compacting, shall not remain undisturbed for more than thirty (30) minutes.

**3. Central Mixing Plant:** The flexible base, cement and water shall be dry-mixed in a pugmill either of the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices which will add the base, cement, and water into the mixer in the specified quantities. Base and cement shall be mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall continue until a uniform and intimate mixture of base, cement, and water is obtained.

The mixture shall be hauled to the construction site in suitable vehicles equipped with protective covers. The mixture shall be placed on the moistened subgrade in a uniform layer by an approved spreader. Not more than thirty (30) minutes shall elapse between the placement of stabilized base in adjacent lanes at any location except at longitudinal construction joints.

Not more than thirty (30) minutes shall elapse between the start of spreading the base and cement mixture and the start of compaction. Not more than sixty (60) minutes shall elapse between the start of moist mixing and the start of compaction. The mixture shall be uniform in thickness and surface, and quantity. The completed cement stabilized base will conform to the required grade and cross section. Dumping of the mixture in piles or windrows upon the subgrade will not be permitted.

Regardless of which of the above three methods is used, all flexible base and cement shall be cleared away from the concrete gutter section for the full depth of the base to insure satisfactory mixing.

**F. Compaction and Finishing:** The cement stabilized base shall be compacted to one hundred (100) percent of Standard Proctor density. At the start of compaction, the moisture percentage in the mixture and in unpulverized soil lumps shall not be below or more than two (2) percent above the optimum moisture content. The base-cement mixture shall not become unstable during compaction and finishing. When the uncompacted base-cement mixture is rained on and the moisture content exceeds the tolerance, the entire section shall be reconstructed.

The optimum moisture content and density of the cement stabilized base shall be determined on representative samples obtained from the area being processed.

Prior to compaction, the mixture shall be in a loose condition for its full depth. The loose mixture then shall be uniformly compacted to the specified density within two (2) hours. After the mixture is compacted, water shall be uniformly applied as needed and thoroughly

mixed in with a spiketooth harrow or equal. The surface shall then be reshaped to the required lines, grades, and cross sections and then lightly scarified to loosen any imprint left by the compacting or shaping equipment.

The resulting surface shall be thoroughly rolled with a pneumatic tire roller and tight bladed by a motor grader to a depth of approximately one-fourth (1/4) inch, moving all loosened base and cement from the section. The surface shall then be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. Other surface finishing methods may be used if a dense, uniform surface is produced. The moisture content of the mixture must be maintained at optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than two (2) hours, a smooth, dense surface, free of cracks, ridges, or loose material conforming to the crown, grade, and line shown on the plans.

**G. Protection and Cover:** After the cement stabilized base has been finished it shall be immediately protected against rapid drying by applying an acceptable bituminous material. Immediately prior to the bituminous material application the section shall be wetted by the use of pressure water distributors so that all voids at the surface in the cement stabilized surface are filled with water but without free water standing on the surface. The bituminous material shall be applied while this moisture condition exists so that undue asphalt penetration of the cement stabilized surface will be prevented. Should it be necessary to use the section before the bituminous material has cured sufficiently to prevent pick-up, the Contractor shall dust or sand the surface before such use. The Contractor shall also maintain this curing cover during the protection period.

**H. Opening to Traffic:** The Contractor shall allow heavy equipment over completed portions, but pneumatic-tired equipment required for hauling cement and water may be permitted after the surface has hardened sufficiently to prevent the equipment from marring the surface, provided protection and cover are not impaired. The cement stabilized base may be opened to local traffic as soon as the bituminous material has been applied and dusted or sanded as necessary to prevent pick up.

**I. Maintenance:** The Contractor shall maintain in good condition the entire section within the project limits. Maintenance shall include immediate repairs of any defect that may occur after the cement is applied. The maintenance work shall be done and repeated as often as may be necessary to keep the section continuously intact. Repairs must insure restoration of a uniform surface and durability. Faulty work shall be replaced for the full depth of treatment. Any low area shall be remedied by replacing the material for the full depth of treatment rather than adding a thin layer of cement stabilized base to the completed work.

**J. Application of Wearing Surface:** The wearing or finish surface shall be placed on the cement stabilized base as soon as operations will permit.

## **V. MEASUREMENT**

This work shall be measured by the square yard of completed and accepted cement stabilized base course, and the dry weight ton for cement. If needed and shown in the project proposal, the compacted volume of additional flexible base to augment the existing base to meet width and depth requirements shall be measured. No allowance will be made for any material used or work done outside the limits as established by the Engineer.

## **VI. PAYMENT**

The work performed and materials furnished as prescribed by this item and measured for cement stabilized base course, cement, and additional flexible base shall be paid for at the unit price bid for cement stabilized base per applicable depth, cement, and additional flexible base. The price shall be full compensation for scarifying and pulverizing existing asphaltic concrete and base courses, for mixing existing asphaltic concrete surface and

base courses with new flexible base added because of depth and width requirements, for mixing cement with the pulverized base, for furnishing, hauling, and mixing water with the cement and base mixture, for spreading and shaping the mixture, compacting the mixture, including all rolling required for the compaction, base surface finishing, curing and for all manipulation, labor, equipment, tools, and incidentals necessary to complete the work.

**LAST PAGE OF THIS SUBSECTION**



**SUBSECTION 4.09  
CONCRETE SEPARATE CURB, CURB & GUTTER,  
SIDEWALKS, DRIVEWAYS, VALLEYS, ALLEY APRONS,  
MEDIANS, ISLANDS AND ALLEYS**

**I. SCOPE**

This item includes Portland cement concrete separate curb, curb and gutter, sidewalks, driveways, valleys, alley aprons, medians, islands and alleys with or without reinforcing steel as required, constructed on an approved subgrade, sand, flexible base, or other foundation. The construction shall conform to the lines and grades established on the plans. The project drawings shall provide details of all concrete work.

**II. MATERIALS**

**A. General:** Unless otherwise specified on the plans, materials shall conform to the requirements as specified in this Subsection.

The cement shall be Type II Portland cement. Type III cement shall be used when high-early strength concrete is required by the plans or special provisions. The Contractor shall obtain written permission of the Engineer, and shall assume all additional costs incurred by his use of another type cement. Cement shall conform to ASTM C 150. When Type III cement is used, the average strength of briquettes at the age of seven (7) days shall be higher than that attained at three (3) days. Either the tensile or the compressive tests may be used for either type cement.

Any cement storage shall be a suitable weather-tight building or bin which will protect the cement from dampness, and cement shall be so placed as to provide easy access for proper inspection and identification of each shipment.

The concrete shall be Class A, consisting of Portland cement, mineral aggregate, and water. When required, the air-entraining agent shall be used in such an amount as will affect the entrainment of between three (3) and seven (7) percent of air, by volume, of the concrete as discharged by the mixer. Other admixtures or blends may be used with the approval of the Engineer.

Concrete for pavement, alley aprons, valleys, drives, walks, alleys, retaining walls, curb and gutter, concrete manholes, inlets, and other structures shall be in such proportions that the twenty-eight (28) day compressive strength shall be 3,000 psi or greater. Concrete for no-joint pipe of cast-in-place non-reinforced pipe sections shall be of such proportions of Portland cement, fine and coarse aggregate, and water that the twenty-eight (28) day compressive strength of the concrete shall be 3,500 psi or greater.

**B. Types:** Portland cement shall conform to one of the types in ASTM C 150 "Portland Cement."

**C. Admixtures:** Unless otherwise provided in the plans or special requirements, approved types of admixtures to minimize segregation, to improve workability, or to reduce the amount of mixing water may be used in the rate of dosage specified by the Engineer. Admixtures shall not be used to replace cement. The following types of admixtures are generally used:

1. **Air-Entraining Admixtures:** Air-entraining admixtures shall conform to ASTM C 260 "Air-Entraining Admixtures for Concrete." An air entraining agent shall be used in all concrete for concrete pavement, alley aprons, concrete valleys, drives, walks, retaining walls, curb and gutter, concrete manholes, inlets, and other exposed structures. The air-

entraining agent shall be between four (4) and seven (7) percent of air, by volume, of the concrete as discharged by the mixer.

2. **Chemical Admixtures:** Accelerating, retarding, and water-reducing admixtures, if used, shall conform to ASTM C 494 "Chemical Admixtures for Concrete." Calcium chloride, if used, shall not exceed two (2) percent by weight of the cement.

3. **Pozzolanic Admixtures:** Fly ash and other pozzolans, when used as an admixture shall conform to ASTM C 618 "Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."

**D. Coarse Aggregate:** Coarse aggregate shall consist of durable particles of gravel, or crushed stone of reasonably uniform quality throughout, free from injurious amounts of salt, alkali, vegetable matter or other objectionable material, either free or as an adherent coating on the aggregate. It shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5.0 percent by weight of laminated and/or friable particles.

Coarse aggregate shall have a wear of not more than forty (40) percent when tested according to AASHTO T 96, and when tested by standard laboratory methods shall meet the following gradations:

Aggregate Grade No.	Nominal Size	2-1/2 Inch	2 Inch	1-1/2 Inch	1 Inch	3/4 Inch	1/2 Inch	3/8 Inch	No. 4	No. 8
1	2 1/2	0	0-20	15-50		60-80			95-100	
2 (467)*	1 1/2		0	0-5		30-65		70-90	95-100	
3	1		0	0-5		10-40	40-75		95-100	
4 (57)*	1			0	0-5		40-75		90-100	95-100
5 (67)*	3/4				0	0-10		45-80	90-100	95-100
6 (7)*	1/2					0	0-10	30-60	85-100	
7	3/8						0	5-30	75-100	
8	No. 4						0	0-5	35-60	90-100

\* Numbers in parenthesis indicate that these gradations conform to corresponding ASTM gradation from ASTM C 33. The number ranges are the percentages retained on individual sieves.

All aggregates shall be handled and stored in such a manner as to prevent size segregation and contamination by foreign substances. When segregation is apparent, the aggregate shall be re-mixed. At the time of its use, the aggregate shall be free from frozen material and aggregate containing foreign materials will be rejected. Coarse aggregate that contains more than 0.5 percent free moisture by weight shall be stockpiled for at least twenty-four (24) hours prior to use.

**E. Fine Aggregate:** Fine aggregate shall consist of sand or a combination of sands, and shall be composed of clean, hard, durable, uncoated grains.

1. **Fine Aggregate Exclusive of Mineral Filler:** Fine aggregate shall be free from injurious amounts of salt, alkali, or vegetable matter. It shall not contain more than 0.5 percent by weight of clay lumps. When subjected to the color test for organic impurities, TxDOT Bulletin C-11, the fine aggregate shall not show a color darker than the standard.

When the fine aggregate is mixed with Type III cement in the proportion of 1:3, the average strength of not less than three (3) standard mortar briquettes at the age of three (3) days shall be equal to or greater than the strength of Ottawa sand mortar briquettes of the same proportions and consistency when tested at the age of three (3) days.

Fine aggregate when tested in accordance with TxDOT Bulletin C-11 shall meet the following gradation:

Material	Percentage by Weight
Retained on 1/4" sieve . . . . .	0%
Retained on No. 4 sieve . . . . .	0 to 5%
Retained on No. 20 sieve . . . . .	15 to 50%
Retained on No. 100 sieve . . . . .	85 to 100%

Material removed by decantation when tested in accordance with TxDOT Bulletin C-11, shall not exceed 4.0 percent by weight.

Where fine aggregate is delivered to the job in two or more sizes or types, each type and/or size of material shall be batched and weighed separately.

At the time of its use, the fine aggregate shall be free from frozen material, and aggregate containing foreign material will be rejected.

All fine aggregate shall be stockpiled for at least twenty-four (24) hours prior to use.

**2. Mineral Filler:** Mineral filler shall consist of clean stone dust, crushed sand, crushed shell, or other approved inert material. When tested in accordance with TxDOT Bulletin C-11, it shall meet the following requirements:

Material	Percentage by Weight
Retained on No. 30 sieve . . . . .	0%
Retained on No. 200 sieve . . . . .	0 to 35%

Where mineral filler is used, it shall be batched and weighed separately.

**F. Water:** Water shall be reasonably clean and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Potable water may be accepted for use. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

**G. Concrete Mortar:** Mortar shall consist of one (1) part cement, two (2) parts finely graded sand and sufficient water to make the mixture plastic.

**H. Curing Materials:**

**1. Burlap:** Burlap shall be made from jute or hemp and, at the time of using shall be in good condition, free from holes, dirt, clay, or any other substance which interferes with its absorptive quality. It shall not contain any substance which would have a deleterious effect on the concrete. Burlap shall be of such quality that it will absorb water readily when dipped or sprayed and shall weigh not less than seven (7) ounces per square yard when clean and dry. Burlap made into mats may be used if care in handling is exercised to avoid marring the finished surface of the concrete.

**2. Cotton Mats:** Cotton mats for curing concrete shall conform to the requirements of AASHTO M 73 "Cotton Mats for Curing Concrete."

**3. Waterproof Paper:** Paper and impermeable sheets for curing concrete shall conform to the requirements of ASTM C 171 "Sheet Materials for Curing Concrete."

**4. Liquid Membrane-Forming Compounds:** Liquid membrane-forming compounds shall conform with the requirements of ASTM C 309 "Liquid Membrane-Forming Compounds for Curing Concrete."

**I. Metal Reinforcement:**

**1. Welded Wire Fabric:** Welded wire fabric shall conform to the requirements of ASTM A 185 "Steel Welded Wire Fabric, Plain, for Concrete Reinforcement."

**2. Bars, Tie Bars, Dowels and Sleeves:** All bars shall conform to ASTM A 615 "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement" Grade 60. Joint hook bolts may be used as an alternative to tie bars. Such bolts shall not be less than one-half (1/2) inch in diameter and should be equipped with threaded couplings. Dowel bars shall not be burred, roughened, or deformed out of round in such a manner as to affect slippage in the concrete. When metal sleeves are used, they shall cover the ends of the dowels for not less than two (2) inches nor more than three (3) inches. The sleeve shall be closed at one end and shall have a suitable stop to hold the end of the bar at least one (1) inch from the closed end of the sleeve. It shall be of such rigid design that the closed end will not collapse during construction.

**3. Supports:** Chairs for holding tie rods, bars, and other structural members in correct position while the concrete is being placed shall be made of material approved by the Engineer prior to use.

**4. Stakes:** Stakes used to support expansion joint fillers shall be channel or U-shaped metal, three-fourth (3/4) inches wide, three-eighth (3/8) inches deep, and not less than sixteen (16) gauge (Manufacturers' standard gauge for steel sheets) in thickness. They shall be a minimum of fifteen (15) inches in length or longer in necessary to provide proper bearing support.

**J. Fiber Reinforcement:**

**1. Types:**

- a. Stainless, alloy, or carbon steel
- b. Alkali resistant glass
- c. Synthetic fiber

**2. Compliance:** All fiber reinforcement shall conform to ASTM C 1116 "Fiber-reinforced Concrete and Shotcrete."

**K. Expansion Joint Material:** Preformed fiber expansion joint material shall be of the dimensions shown on the plans. The material may be the following types unless specifically noted otherwise on the plans. Preformed bituminous fiber material shall conform to ASTM D 1751 "Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and resilient bituminous types)." Preformed non-bituminous fiber material shall conform to ASTM D 1752 "Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction."

**L. Joint Sealing Material:** Unless otherwise shown on the plans, joint sealing material shall conform to the requirements for one of the classes listed herein. The material shall adhere to the sides of the concrete joint or crack and shall form an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperatures.

**Class 1 (Synthetic Polymer):**

**a. Two Liquid Component-Synthetic Polymer Type:** This sealer shall be a two-liquid component, cold-extruded, synthetic polymer, which will form an effective seal against water and incompressibles. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.

**b. Two Components, Liquid & Solid, Synthetic Polymer Type:** This sealer shall be a two-component (liquid and solid) cold-poured synthetic polymer, which will form an effective seal against water and incompressibles. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.

The material, when tested in accordance with Test Method TxDOT-525-C, shall meet the following requirements:

It shall cure sufficiently in three hours so that it will not pick up under wheels of traffic.

It shall be of such consistency that it can be mixed and poured, or mixed and extruded into joints at temperatures above sixty degrees 60° F.

Penetration, 77° F.	
150 gms. Cone, 5 sec., max.-cm . . . . .	0.90
Bond and Extension 75%, 0°F, 5 cycles:	
Dry Concrete Blocks . . . . .	Pass
Wet Concrete Blocks . . . . .	Pass
Steel Blocks (Primed if specified by manufacturer) . . . . .	Pass
Flow at 200° F . . . . .	None
Water content % by weight, max . . . . .	5.0
Resilience:	
Original sample min. % (cured) . . . . .	50
Oven aged at 158° F. min. % . . . . .	50
For Class I - a material only	
Cold Flow (10 min.) . . . . .	None

**Class 2 (Hot Poured Rubber):** This sealer shall be a rubber asphalt compound which when heated shall melt to the proper consistency for pouring and shall solidify on cooling at atmospheric temperatures.

The material, when tested in accordance with Test Method TxDOT-525-C, shall meet the following requirements:

Penetration:	
32° F., 200 grams, 60 seconds . . . . .	not less than 0.28 cm
77° F., 150 grams, 5 seconds . . . . .	0.45 to 0.75 cm
Flow:	
5 hours, 140° F., 75° incline . . . . .	not more than 0.5 cm
Bond and Extension:	
15° F., 5 cycles . . . . .	There shall be no cracking of the joint sealing material or break in bond between the joint materials and the mortar pieces.

**Class 3 (Ready-Mixed Cold-Applied Joint and Crack Sealer):** This sealer shall consist of a homogeneous blend of asphalt, rubber, inert filler, and a suitable solvent or solvents. The material shall be a resilient, adhesive compound capable of effectively sealing properly cleaned joints against the infiltration of moisture throughout repeated cycles of contraction

and expansion and which will not be picked up by vehicle tires, particularly at summer temperatures.

The material, when tested in accordance with Test Method TxDOT-525-C, shall meet the following requirements:

**Penetration:**

At 77° F: (As received) 150 grams, 5 seconds...not less than 2.75 cm  
(After evaporation of solvent) 150 grams, 5 seconds... not more than 2.20 cm

At 32° F: (After evaporation of solvent) 200 grams, 60 seconds...  
not less than 1.00 cm

Flow: Not more than 0.5 cm

Bond: There shall be no cracking of the material or failure in bond between the material and the mortar test blocks during or at the end of five (5) cycles.

### III. EQUIPMENT

The equipment requirements of the remaining subsections shall apply.

### IV. CONSTRUCTION METHODS

**A. Subgrade Preparation:** Subgrade shall be excavated and shaped to line, grade, and cross section. If dry, the subgrade shall be sprinkled lightly immediately before concrete placement.

The subgrade shall be excavated to the correct elevation. Any fill required shall be furnished by the Contractor and approved by the Project Representative. The subgrade in fill areas shall be brought to correct elevation by placing like soil or flexible base in layers not to exceed four (4) inches in depth. Each layer shall be brought to  $\pm$  two (2) percent of optimum moisture and compacted to a density of ninety five (95) percent of Standard Proctor in the upper six (6) inches of subgrade. In alleys the Contractor shall excavate around and take precautions to protect all existing improvements. All obstructions and improvements that must remain where concrete pavement is placed shall be wrapped with two (2) layers of fifteen (15) pound roofing felt to the level of the top surface of the slab. Any damage to an existing improvement caused by the Contractor shall be repaired.

Excavated material from alley apron construction, shall be removed within twenty-four (24) hours after subgrade preparation.

**B. Forming:** Forms shall be of wood or metal, of a satisfactory section, straight, free from warp, and of a depth equal to the thickness of the finished work. They shall be securely staked to line and grade and maintained in a true position during concrete placement. Inside forms for the curb shall be of approved material and shall be of such design as to provide the curb required and shall be rigidly attached to the outside forms. Face forms on curb radii may be omitted if a true section and an accurate flow line can be obtained by other methods.

Forms shall remain in place at least twelve (12) hours after placement of concrete. Forms shall be oiled with a light oil before each use and forms which are to be re-used shall be cleaned immediately after use and maintained in good condition.

**C. Reinforcing:** The reinforcing steel bars and/or dowels shall be of the correct size and dimension and shall be placed and secured in position as shown on the plans.

Where welded wire mesh reinforcement is specified, the mesh shall lap not less than seven (7) inches and shall be securely tied. All wire mesh shall be neatly cut to the shape of the

construction and to fit around all obstructions. Reinforcing bars at proper spacing may be substituted for welded wire mesh.

**D. Concrete:** Concrete shall be satisfactorily mixed, placed in the forms to the depth specified, spaded, and tamped until thoroughly compacted. The top surface shall be finished with a wooden float to a gritty texture.

Should a chute be used in placing concrete, the slope of the chute and the delivery end of the chute shall be such that the concrete will flow without separation. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each run. The flushing shall discharge outside the forms.

All concrete surfaces shall be reasonably true and even, free from pockets, depressions or projections, and given a steel trowel finish and then a light brush finish.

An edging tool with a radius of approximately one quarter of an inch (1/4) shall be used along each edge of a sidewalk, the top back edge of the curb, along the front edge of the gutter, and along each side of each expansion joint.

All concrete shall be properly cured by being kept moist for three (3) days with wetted burlap or mats, or by an approved process. Concrete may be cured by applying a liquid membrane coating (curing compound) to all exposed surfaces.

The curb and gutter shall be backfilled to the full height of the concrete, tamped and sloped as directed.

Concrete shall be deposited that requires minimum rehandling and obtain a uniformly dense section, free of honeycombs, and conforming to line, grade, and cross section.

In general, the consistency of the concrete mixture shall be such that:

1. The mortar will cling to the coarse aggregate;
2. The concrete is not sufficiently fluid to segregate when transported to the place of deposit;
3. The concrete, when dropped directly from the discharge chute of the mixer, will flatten out at the center of the pile; but the edges of the pile will stand up and not flow;
4. The mortar will show no free water when removed from the mixer;
5. The concrete will settle into place when deposited in the forms; and when transported in metal chutes at an angle of thirty degrees (30°) with the horizontal, it will slide and will not flow into place;
6. The surface of the finished concrete will be free from laitance or a surface film of free water.
7. Slump shall not exceed four (4) inches.

Other concrete placement methods such as a slip form machine for curb and gutter is allowable if the concrete can meet these specifications.

**E. Shrinkage Crack Control:** Concrete shall be below the allowable temperature as determined by the Contractor by using the accompanying ACI 305 chart (modified). The rate of evaporation of water from the concrete shall not exceed 0.15 lbs per square foot per hour. The Contractor shall keep a log of air temperatures, relative humidities, wind velocities and allowable concrete temperature for each day he places concrete. The log shall be readily available for review by the Project Representative.

**MAXIMUM ALLOWABLE CONCRETE TEMPERATURE  
FAHRENHEIT**

Air Temperature	Relative Humidity	Allowable Concrete Temperature				
		Wind Speed				
		5 mph	10 mph	15 mph	20 mph	25 mph
50	10	86	72	63	58	52
60	10	87	73	64	59	53
70	10	88	74	66	60	56
80	10	89	75	68	61	58
90	10	90	77	70	63	60
100	10	91	79	71	65	61
50	30	89	76	68	61	58
60	30	90	78	70	63	60
70	30	92	80	72	68	63
80	30	93	82	75	71	68
90	30	96	85	79	75	71
100	30	99	89	83	80	78
50	50	90	78	70	65	61
60	50	92	80	74	70	67
70	50	95	83	78	73	70
80	50	98	88	82	79	76
90	50	100	92	88	84	82
100	50	100	97	93	90	88
50	70	89	80	72	69	65
60	70	95	83	78	72	70
70	70	98	88	81	78	75
80	70	100	91	87	84	81
90	70	100	98	93	90	89
100	70	100	100	100	97	96

For air temperatures, relative humidities and wind speeds other than what is listed, the next highest temperature shown, next lowest relative humidity, and next highest wind velocity interval shall be used to determine acceptable concrete temperature.

Contractor is to inform the concrete supplier of the temperature requirements prior to delivery to the project. The concrete temperature limit shall not be exceeded at least until fifteen minutes after surface finishing. Appropriate curing methods shall be used to prevent shrinkage cracks in conjunction with these concrete temperature requirements.

An example for concrete temperature determination is with an air temperature of eighty-three degrees (83°), relative humidity of twenty (20) percent and wind velocity of 18 mph, the chart would be read at ninety degrees (90°) air temperature, ten (10) percent relative humidity and twenty (20) mph wind velocity and a resultant maximum concrete temperature of sixty-three degrees (63°).

Concrete shall not be poured when wind or weather conditions are such that dirt, sand, or debris enters the concrete. No concrete will be placed when wind speeds exceed twenty-five (25) miles per hour. The concrete shall be protected to maintain temperatures of not less than fifty degrees (50°)F for five (5) days after placement. If aggregate and water are heated, they shall not be heated above one hundred and seventy-five degrees (175°)F. Concrete shall not be placed when ambient temperature is less than forty degrees (40°)F. It shall be the responsibility of the Contractor to anticipate as nearly as possible changes in weather conditions which would affect the placement and protection of the concrete and to be prepared to protect freshly placed concrete when sudden changes in the weather make such protection necessary.

**F. Sidewalks:** All sidewalks and step treads shall have a minimum transverse slope of one quarter (1/4) inch per foot and a maximum transverse slope of one half (1/2) inch per foot. Care shall be exercised to match the grade of sidewalk to the top of curb (where applicable) and to the grade of driveways, if any. Care shall also be taken to ramp sidewalk to tie flush with alley paving.

All sidewalks constructed at a location designated on the plans shall be not less than four (4) feet in width.

**G. Expansion Joints and Scoring:** Expansion joints shall be placed at intervals not to exceed thirty (30) feet in the sidewalk and in the curb and gutter and at such other locations as may be shown on the plans. Expansion joints shall be placed vertically and at right angles to the longitudinal axis of the sidewalk or curb and gutter. An expansion joint shall be placed at the end of each radius where the radius connects onto concrete curb and gutter. Forethought shall be used in the spacing of expansion joints and also in the spacing of the scoring so as to have approximately equal spacings and so that no short or long spacings will exist.

Where a sidewalk or curb and gutter is being constructed adjacent to or abutting existing concrete construction, an expansion joint shall be placed between the new and the existing concrete. Expansion material shall also be placed around all obstructions protruding through sidewalks or driveways.

All expansion joints shall be premoulded expansion joint monolithic with that of the gutter portion of the curb and gutter and shall be cut true to shape so that the edge of the expansion joint will be approximately one quarter (1/4) inch below the face and the top of the curb. Those expansion joints in sidewalk shall be placed in the same manner.

Scoring shall be placed in sidewalks and curb and gutters by the use of approved jointing tools. If both are being constructed or if only a sidewalk is being constructed, the spacing of the scoring shall be equal to the width of the sidewalk. If only curb and gutter is being constructed, the spacing of the scoring shall be ten (10) feet or less.

H. **Steps:** All steps shall have a tread of not less than twelve (12) inches and a riser of not more than seven (7) inches. Where more than one step is constructed at a location, the treads and risers for each shall be of equal dimension.

I. **Horizontal and Vertical Control:** The Contractor shall follow and preserve all lines, grades, marks, and stakes given by the Engineer. The Contractor shall notify the Engineer at least four hours prior to needing such lines, grades, marks, and stakes.

The Contractor shall have no redress for any delays occurring in the setting of any lines, grades, marks, and stakes, when proper requests were not given by the Contractor.

All forms for concrete work shall be inspected and checked by the Project Representative to insure their compliance with established lines and grades before any concrete is poured. The Contractor shall notify the appropriate department at least four hours prior to pouring of any concrete to have forms checked. No concrete is to be poured until the Project Representative accepts the forms, foundation conditions, amount, size, and location of reinforcement.

J. **Protection:** The Contractor shall provide and maintain all necessary barricades and sufficient lights, signals, signs, watchmen, and any and all other things necessary for the protection of the work and for the safety of the public.

The Contractor must protect his work against weather, vandals, and any and all things that may mar the finish, surface, or the appearance of the concrete. Any damage to the surface is cause for rejection of all concrete between the expansion joints on either side of the damaged surface.

K. **Backfill and Repair of Damaged Concrete in Alley Pavement:** The area between the alley slab and the property line shall be filled and or shaped as required to obtain the specified cross section and to provide a smooth, even slope from the edge of the alley slab to the property line. Backfill between the alley slab and the property line shall be compacted to a density at least that of the adjacent undisturbed soil. No blading will be permitted on the concrete alley pavement.

Only damage of a very minor nature shall be repaired by approved patching. Any substantial damage to the concrete alley pavement is cause for rejection of that section of pavement between expansion joints on either side of the damaged area, and the damage shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

## V. MEASUREMENT

Concrete separate curb and concrete curb and gutter will be measured by the linear foot, complete in place. Work and accepted material as prescribed for sidewalks, driveways, islands, medians, alleys or similar concrete construction will be measured by a unit of surface area installed complete.

## VI. PAYMENT

The work performed and materials furnished as prescribed by this item and measured as provided will be paid for at the unit price bid. The prices shall each be full compensation for preparing the subgrade; for furnishing and placing all materials, including all reinforcement and expansion joint materials; for furnishing, placing, shaping and tamping backfill; and for all manipulation, labor, tools, equipment, and incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION

**SUBSECTION 4.10  
MILLING, HEATER-SCARIFICATION, REJUVENATION  
AND HOT-MIX ASPHALTIC CONCRETE OVERLAY FOR STREETS**

**I. SCOPE**

This item includes the associated concrete and pavement reconstruction, surface preparation, heating and scarifying, rejuvenation agent application, compaction and hot-mix asphaltic concrete overlay for streets as detailed on the project plans.

All applicable Subsections of the City of Amarillo Standard Specifications, as currently revised, shall govern those portions of the work, materials, equipment, or procedures not described in this subsection.

Certain streets of the project may be deleted by the Engineer when existing surface conditions or utility installation and repair precludes construction. New streets may be added at other locations so that total bid item quantities in the proposal should remain essentially unchanged.

**II. MATERIALS**

**A. Asphaltic Concrete Rejuvenating Agent:** The rejuvenating agent shall be "Reclamite" as manufactured by the Witco Company or approved equal.

**B. Asphaltic Concrete:** The hot mix asphaltic concrete shall comply with Subsection 4.13 "Hot Mix Asphaltic Concrete."

**C. Portland Cement Concrete:** The concrete shall comply with Subsection 4.09 "Concrete Separate Curb & Gutter, Sidewalks, Driveways, Valleys, Alley Aprons, Medians, Islands and Alleys."

**III. EQUIPMENT**

Contractor shall furnish all machinery, tools, equipment, and qualified equipment operators necessary for the proper prosecution and completion of the work. Failure to comply with the plans, specifications, or instructions of the Project Representative may cause suspension of the work or withholding monthly payments.

All equipment shall be maintained in good repair and operating condition and shall be approved by the Project Representative prior to use.

**IV. CONSTRUCTION METHODS**

**A. Construction Limitations:** Once construction begins on a street, the Contractor shall continuously work on that particular street until completed. A street may be segmented for this determination if the Engineer determines the total length is too long. This requirement does not preclude the Contractor from scheduling his individual crews to work on more than one street at a time. No street shall be abandoned by the Contractor more than ten (10) working days as determined by the Project Representative. Each street shall be considered to be independent and liquidated damages shall be assessed at two hundred dollars (\$200) per working day when no work has been performed as determined by the Project Representative. The liquidated damages shall be charged for the period from the first day of abandonment. Any delay for utility relocations and/or adjustments verified by the Project Representative shall cancel liquidated damages on a particular street. Cancellation of liquidated damages shall be determined jointly by the Project Representative

and Engineer. When charged working days for each street exceeds fifteen (15) after Contractor abandonment, the liquidated damages increase to four hundred dollars (\$400) per day. Cleanup or repair operations will not reduce liquidated damages during the periods a street has been considered abandoned by the Contractor.

During concrete and pavement reconstruction, milling, heater-scarifying, rejuvenation agent application, and hot mix asphaltic concrete laying operations, the Contractor shall have at least two flagpersons to facilitate traffic control.

On all street intersections in this project that do not have valley gutters crossing the side street, the entire intersection out to the curb returns of the side street shall be heater-scarified and overlaid as specified.

The temperature of any surface that the asphaltic concrete is to be laid upon shall be above fifty degrees (50°) F. The surface shall be clean and no stormwater runoff shall be present. The equivalent air temperature as determined by the wind chill factor shall not be below forty-five degrees (45°) F.

All construction shall be performed when adequate time and weather conditions are available. The Contractor shall not start any work that may be finished in weather conditions less than previously specified. The Contractor shall be responsible for removal and replacement of construction unacceptable due to weather conditions.

**B. Surface Preparation:** Sufficient existing pavement shall be removed adjacent to the toe of gutter joint and along the edge of valley gutters to permit the finished elevation of a minimum one (1) inch overlay to be a maximum of one-fourth (1/4) inch above the gutter elevation. The tapering of the existing surface to the gutter line cut shall be accomplished in a minimum of three (3) feet. The design intent is have a depth of one (1) inch for the new asphaltic concrete at the toe of gutter unless a different depth is specified.

If the existing asphaltic concrete pavement is too thin when trimmed and/or the milling exposes base material, an appropriate layer of new asphaltic concrete shall be laid in the milled area to prevent moisture from penetrating the base material.

Where the proposed overlay abuts existing asphaltic concrete pavement, the joint shall be scored and cut smooth and prepared in a manner similar to toe of gutter joints. On collector or arterial streets, the joints shall be trimmed not more than five (5) working days prior to the overlay of said pavement. The trimming and subsequent overlay shall not violate completion requirements. The tapering of the joints shall be done in a minimum of ten (10) feet or as directed by the Engineer. At Portland cement concrete valleys, the existing asphaltic concrete surface shall be further trimmed or milled each way as necessary for a smoother transition.

All loose material caused by trimming and milling shall be removed before heater-scarifying of the existing pavement is permitted. Excavated materials shall be removed from the job site by the Contractor and the surface to be overlaid swept with a power broom.

All excessive irregularities, depressions, or shoves in the existing pavement shall be corrected prior to the heating and scarifying operation. Apparent base failures or work requiring base stabilization as determined by the Project Representative will be repaired by City forces prior to the notice to proceed or coordinated with the Contractor on each street in the project.

Milling along traffic islands and medians is required. The milling shall provide proper drainage away from islands and medians.

**C. Heating and Scarifying:** The existing asphaltic concrete pavement surface shall be uniformly heated to a temperature of not less than two hundred twenty-five degrees (225°) F and not more than three hundred degrees (300°) F immediately prior to scarification. The heated surface shall then be scarified to a depth of not less than three-fourths (3/4) of an inch with pressure loaded scarifying teeth spaced at not more than one (1) inch apart. The scarifying teeth shall not produce a pattern in the existing pavement where areas are not scarified. The scarifying teeth shall be equipped to release pressure to pass over manholes, water valves, and other obstructions in the shortest distance possible. Longitudinal joints of scarified areas shall overlap a minimum of four (4) inches. The entire existing pavement surface to be overlaid shall be heated and scarified. If the transverse slope of the existing paving prevents heating and scarifying the milled area adjacent to the toe of the gutter, the Contractor shall provide other means to heater scarify this particular area. The heater-scarifier operation shall be slow enough to perform in a satisfactory manner without charring of the asphalt or differential softening of the pavement.

There shall be no burning of trees, shrubs, or other landscaping adjacent to the street. It shall be the responsibility of the Contractor to protect the adjacent landscape from heat damage and to replace any landscape items which are damaged at his own expense.

The contractor shall provide sufficient labor and equipment to smooth any irregularities in the scarified surface prior to the recompaction of the scarified material.

The scarified depth of the existing pavement shall be determined by weighing material scarified that is contained in an eight (8) inch diameter sieve after the sieve is embedded immediately behind the scarifying operation. The scarified material from the sieve shall weigh three (3) pounds or more.

**D. Rejuvenating Agent Application and Water Mixture:** The mixture of water and rejuvenating agent shall be applied to the scarified pavement surface at a rate of approximately 0.10 gallons per square yard.

When the street is opened to traffic after application of the rejuvenating agent and prior to the overlay, the Contractor shall be responsible for the treated surface to prevent any problems with surface texture, skid resistance, and vehicle damage. Application of sand or other blotting material is required to facilitate traffic movement.

The application rate of the rejuvenating agent shall be synchronized with the operating speed of the distributor. The distributor shall be able to instantaneous start or shut off the rejuvenating agent. A hand spray system shall also be provided for areas inaccessible to the distributor's spray bar.

**E. Scarified Pavement Compaction:** If the overlay operation does not immediately follow heater-scarification and rejuvenating agent application, the pavement surface shall be recompacted with a steel-wheel roller weighing not less than ten (10) tons.

Temporary markings for proper traffic control shall be placed by the Contractor immediately after the scarified pavement is compacted.

**F. Hot-Mix Asphaltic Concrete Overlay:** Following application of the rejuvenating agent, the entire pavement surface shall be overlaid with Class A, Type D hot-mix asphaltic concrete in accordance with Subsection 4.13 "Hot-Mix Asphaltic Concrete." The hot-mix asphaltic concrete overlay shall be placed with a self-propelled spreading finishing laydown machine approved by the Engineer. The laydown machine shall be equipped with an automatic screed control. A shoe or other device to assist in controlling longitudinal grade shall be used on the laydown machine at all times.

The total compacted depth of the heated and scarified material and the new hot-mix asphalt concrete overlay shall be a minimum of one and three-fourth (1 3/4) inches of compacted material. The compacted thickness of the new asphaltic concrete overlay shall be a minimum of one (1) inch. Probe or core tests into the completed surface for every five thousand square yards or portion thereof will be made to determine the thickness of the new overlay plus the scarified material.

The Contractor shall coordinate his overlay operations on each street to allow the Traffic Engineering Department to immediately stripe each completed street.

**G. Concrete and Paving Repair prior to Heating and Scarification:** All applicable Subsections of the City of Amarillo Standard Specifications, as currently revised, shall govern those portions of the work, materials, equipment, or procedures for the removal and replacement of concrete and paving within the scope of this project.

The required pavement tie-ins adjacent to all the new concrete shall be completed within three (3) working days or sooner.

Concrete sidewalks and driveways to be removed are shown on the plans. All concrete spandrels required to be removed and replaced on this project are shown on the plans. Where possible, and when sidewalks are in good condition, the top of curb is to tie to existing sidewalk. This may be accomplished when the curb height is between 0.4 feet to 0.6 feet.

The contractor shall install and maintain either permanent or temporary asphaltic concrete pavement repairs at the concrete and paving repair locations which are more than five working days old. The contractor shall immediately install and maintain either permanent or temporary asphaltic concrete pavement repairs for all locations which are anticipated to be more than five working days old before the milling and trimming operations are completed.

## V. MEASUREMENT

Work and accepted material as prescribed by the various bid items contained in the proposal will be measured by the appropriate unit for payment.

Portland cement concrete spandrels shall be measured for payment as two separate items. The first bid item shall be for the lineal feet of curb and gutter, measured along the face of the curb. The second bid item shall be the remainder of the flatwork and its associated subgrade preparation, reinforcement, sand cushion, and forming required.

Milling along the toe of gutter line, concrete valley edges, median and island edges, and other locations will be measured for payment.

The asphaltic concrete laid in milled areas where base material was exposed will be measured for payment. The milled areas must not have resulted from inadequate or incorrect Contractor operations. The Contractor shall immediately notify the Project Representative when existing base material is exposed.

All temporary markings and striping shall not be measured for payment but will be considered subsidiary to the remaining bid items.

## VI. PAYMENT

The Contractor shall furnish all labor, materials, equipment, tools, manipulation and whatever else may be necessary to provide surface preparation, heating, scarifying,

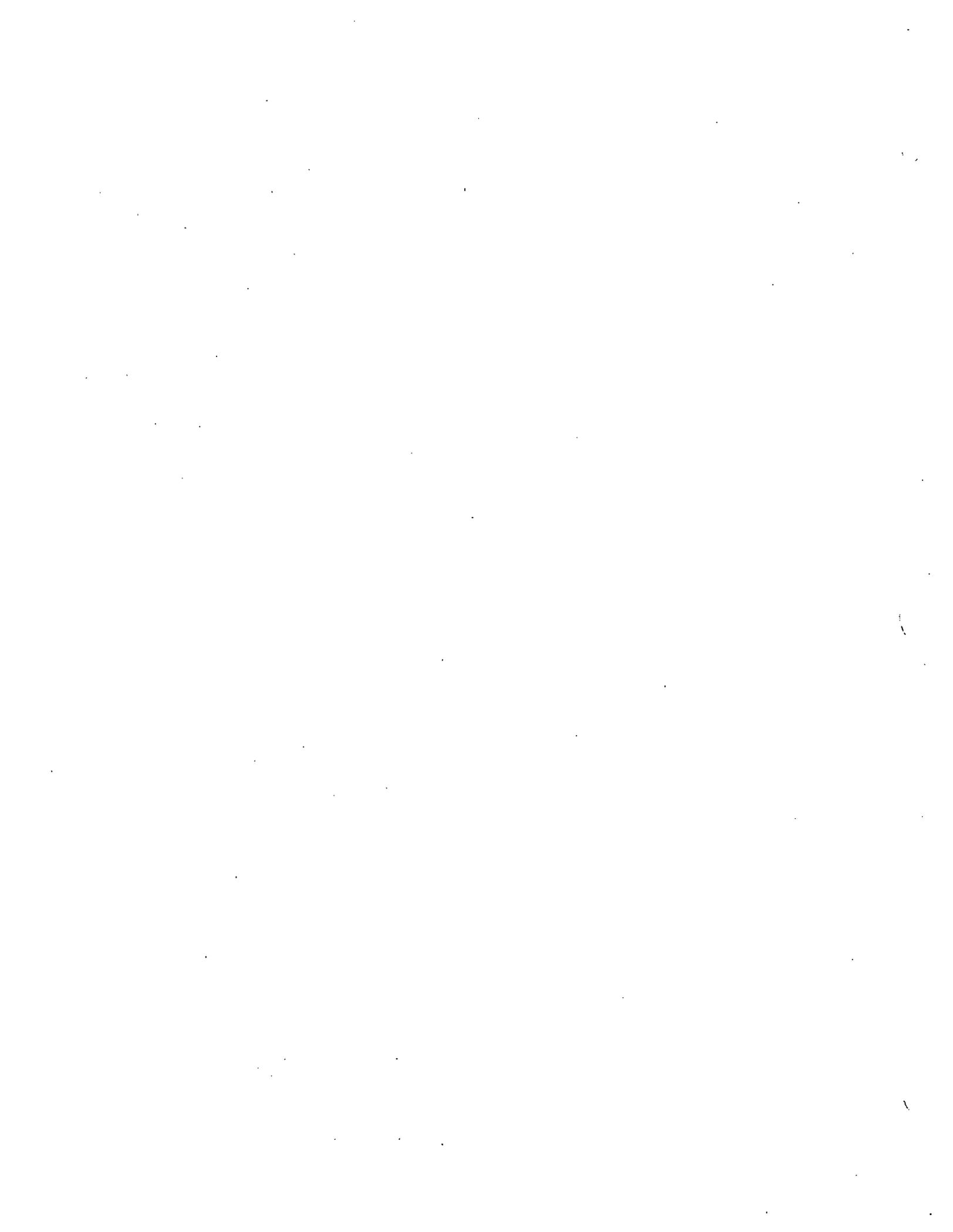
treatment with rejuvenating agent, compaction, and overlaying of various existing asphaltic concrete street surfaces. The unit prices bid shall be full compensation for the above described construction.

Trimming, joint preparation abutting existing pavement, leveling work, and all other surface preparation shall be considered subsidiary to the price bid for the heating and scarifying operation. No separate payment will be made for surface preparation except as provided.

Rejuvenating agent as stated in the project proposal will be paid for in diluted gallons, two (2) parts of rejuvenating agent and one (1) part of water.

The unit prices bid for concrete removal and replacement of concrete drives, walks, and other improvements, will be full compensation for all labor, material, equipment, tools, and necessary labor for removal and replacement of all concrete work in a workmanlike manner.

The unit price bid for asphaltic concrete paving removal and replacement will be full compensation for neat cut of asphalt surface, asphalt paving removal and its replacement.



**SUBSECTION 4.11  
SEAL COAT  
(SMALL AGGREGATE)**

**I. SCOPE**

This item includes a wearing surface composed of one application of asphalt and one course of aggregate on the existing paved surfaces or prepared flexible base.

Seal Coat shall not be applied when the air temperature is below sixty degrees (60°)F. and is falling. The temperature to be taken in the shade and away from artificial heat. No asphalt shall be placed when general weather conditions are not suitable.

**II. MATERIALS.**

When tested according to TxDOT Methods, the various materials shall meet the applicable requirements.

**A. Asphalt Cement:** The material shall be homogeneous, shall be free from water, shall not foam when heated to three hundred and forty-seven degrees (347°) F. and shall meet the following requirements:

**VISCOSITY GRADE**

<u>Properties</u>	<u>AC-3</u>		<u>AC-5</u>		<u>AC-10</u>		<u>AC-20</u>	
	<u>Min</u>	<u>Max</u>	<u>Min</u>	<u>Max</u>	<u>Min</u>	<u>Max</u>	<u>Min</u>	<u>Max</u>
Viscosity, 140°F stokes.....	300	100	500	100	1000	200	2000	400
Viscosity, 275°F stokes.....	1.1	---	1.4	---	1.9	---	2.5	---
Penetration, 77°, 100 g, 5 sec	210	---	135	---	85	---	55	---
Flash Point, C.O.C., F....	425	---	425	---	450	---	450	---

**B. Emulsions:** The material shall be homogeneous. It shall show no separation of asphalt after thorough mixing and shall meet the viscosity requirements at any time within thirty (30) days after delivery:

**ANIONIC EMULSIONS**

TYPE	Rapid Setting				Medium Setting				Slow Setting			
	RS-2		RS-2h		MS-2		MS-2h		MS-1		SS-1	
GRADE	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Properties	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Furol viscosity at 77 F.sec.....	---	---	---	---	---	---	---	---	30	100	30	100
Furol Viscosity at 122 F.sec.....	150	400	150	400	100	300	100	300	---	---	---	---
Residue by Distillation, %.....	65	---	65	---	65	---	65	---	60	---	60	---
Oil Portion of Distillate, %.....	---	2	---	2	---	2	---	2	---	2	---	2
Sieve Test, %.....	---	0.1	---	0.1	---	0.1	---	0.1	---	0.1	---	0.1
Miscibility (Standard Test).....	---	---	---	---	---	---	---	---	Passing		Passing	
Coating.....	---	---	---	---	---	---	---	---	Passing		---	---
Cement Mixing, %....	---	---	---	---	---	---	---	---	---	---	---	2.0
Demulsibility 50 cc of N/10CaCl <sub>2</sub> , %.....	---	---	---	---	---	---	---	---	---	70	---	---
Demulsibility 35 cc of N/10CaCl <sub>2</sub> , %.....	60	---	60	---	---	30	---	30	---	---	---	---
Storage Stability, 1 day, %.....	---	1	---	1	---	1	---	1	---	1	---	1
Freezing Test, 3 Cycles*.....	---	---	---	---	Passing		Passing		Passing		Passing	
Tests on Residue: Penetration at 77°F, 100 g, 5 sec.....	120	160	80	110	120	160	80	110	120	160	120	160
Solubility in Trichloroethylene %	97.5	---	97.5	---	97.5	---	97.5	---	97.5	---	97.5	---
Ductility at 77°F., 5 cm/min, cms.....	100	---	100	---	100	---	100	---	100	---	100	---

**C. Storage, Heating and Application Temperatures:** Asphaltic materials should be applied at the temperature which provides proper and uniform distribution and within practical limits. Satisfactory application usually should be obtained within the recommended ranges shown below. Heating of asphaltic materials constitutes a fire hazard to various degrees. Proper precautions should be used in all cases. Attention is called to the fact that asphaltic materials are very flammable. The utmost care shall be taken to prevent open flames from coming in contact with the asphaltic material or the gases of same. The Contractor shall be responsible for any fires or accidents which may result from heating the asphaltic materials. No material shall be heated above the following maximum temperatures:

TYPE - GRADE	<u>Application and Mixing</u>		Heating and Storage Maximum, F
	Recommended Range, F	Maximum Allowable, F	
AC-5, 10, 20, 40.....	275-350	375	400
AC-3.....	220-300	350	350
SS-1, MS-1, CSS-1, CSS-1h.....	50-130	140	140
RS-2, RS-2h, MS-2, MS-2h, CRS-2, CRS-2h, CMS-2, CMS-2h, HFRS-2, AES-300.....	110-160	170	170

**D. Aggregate:** The aggregate shall be composed of sound and durable particles of gravel or stone, shall be free from organic matter, clay, loam, or pebbles coated therewith, and shall not contain more than five (5) percent of slate, shale, schist, or soft particles of sandstone.

The aggregate shall have a percent of wear of not more than thirty-five (35) (Los Angeles Abrasion Test of Coarse Aggregate, AASHTO T-96.

When tested by approved laboratory methods, each shall meet the requirements for grading specified.

**AGGREGATE**

<u>Single Course Aggregate</u>	Retained on 5/8" sieve . . . . .	0
	Retained on 1/2" sieve . . . . .	0-2
	Retained on 3/8" sieve . . . . .	20-35
	Retained on No. 4 sieve . . . . .	95-100
	Retained on No. 10 sieve . . . . .	99-100

**III. EQUIPMENT**

The equipment requirements of Subsection 4.13 "Hot Mix Asphaltic Concrete" shall apply.

**IV. CONSTRUCTION METHODS**

The aggregate shall be spread with acceptable spreading machines.

The surface of the material to be sealed shall be cleaned of dust, dirt, of other deleterious matter by sweeping or other approved methods. The surface shall be lightly sprinkled just prior to the first application of asphalt. All storage tanks, piping, retorts, booster tanks, and distributors used in storing or handling asphalt shall be kept clean and in good operating condition at all times, and they shall be operated in such manner that there will be no contamination of the asphalt with foreign material. The Engineer will select the temperature of application, and the Contractor shall apply the asphalt at a temperature

within fifteen degrees (15°) F. of the temperature selected. All asphalt material over heated will be rejected.

Asphalt shall be applied on the clean surface by an approved type of self-propelled pressure distributor so operated as to distribute the material in the quantity specified, evenly and smoothly, under a pressure necessary for proper distribution. The Contractor shall provide all necessary facilities for determining the temperature of the asphalt in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two (2) distributor loads. The Contractor shall furnish a man to strap the distributor immediately prior to and immediately after each application. The surface shall next be covered with the Single course aggregate by an approved spreader device. The entire surface shall be thoroughly rolled with an approved self-propelled three-wheeled roller weighing between three (3) and six (6) tons. After the work has been completed, as specified above, there should be a slight excess of aggregate on the surface. The asphalt and aggregate shall be applied at the approximate rates indicated on plans within the limits of the following schedule, as directed by the Engineer.

<u>Application</u>	<u>Gallons of Asphalt Per Sq. Yd.</u>		<u>Aggregate Cu. Yds. to Sq. Yds.</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
First & Only	0.22	0.30	1:110	1:90

The Contractor shall be responsible for the maintenance of the surface and the distribution of the excess aggregate until the work is accepted by the Engineer.

The Contractor shall furnish the Engineer certified records of asphalt and aggregate used.

A course of not less than thirty (30) inch twenty (20) pound paper shall be placed and securely weighted at the beginning and at the end of each section of sealcoat and also at the junction of distributor loads within the project if clean and neat edge lines have not been obtained. All paper used at the beginning or the ends of distributor shots shall be removed from the project by the Contractor.

The Contractor shall protect the curb and gutter from being spotted and/or speckled with asphalt. Any asphalt that may get on the curb and/or gutter shall be removed. The Contractor shall be responsible for any and all damage to any property due to the asphalt distribution.

All covers on manholes, valve boxes, cut-off boxes, meter boxes, and any and all other metal covers and/or lids which are within the project shall be covered, prior to the first application of asphalt, with a course of paper securely weighted to insure keeping the metal free of asphalt. After the project is otherwise completed, the covers and lids shall be cleaned and the protecting material removed from the project.

No longitudinal nor horizontal asphalt joints shall be within two (2) feet of the joint of the asphalt immediately below it, except those joints adjacent to the toe of the gutter and those joints at the beginning and at the end of the project.

## V. MEASUREMENT

Asphalt shall be measured in gallons as calculated at the applied temperature and immediately prior to the application.

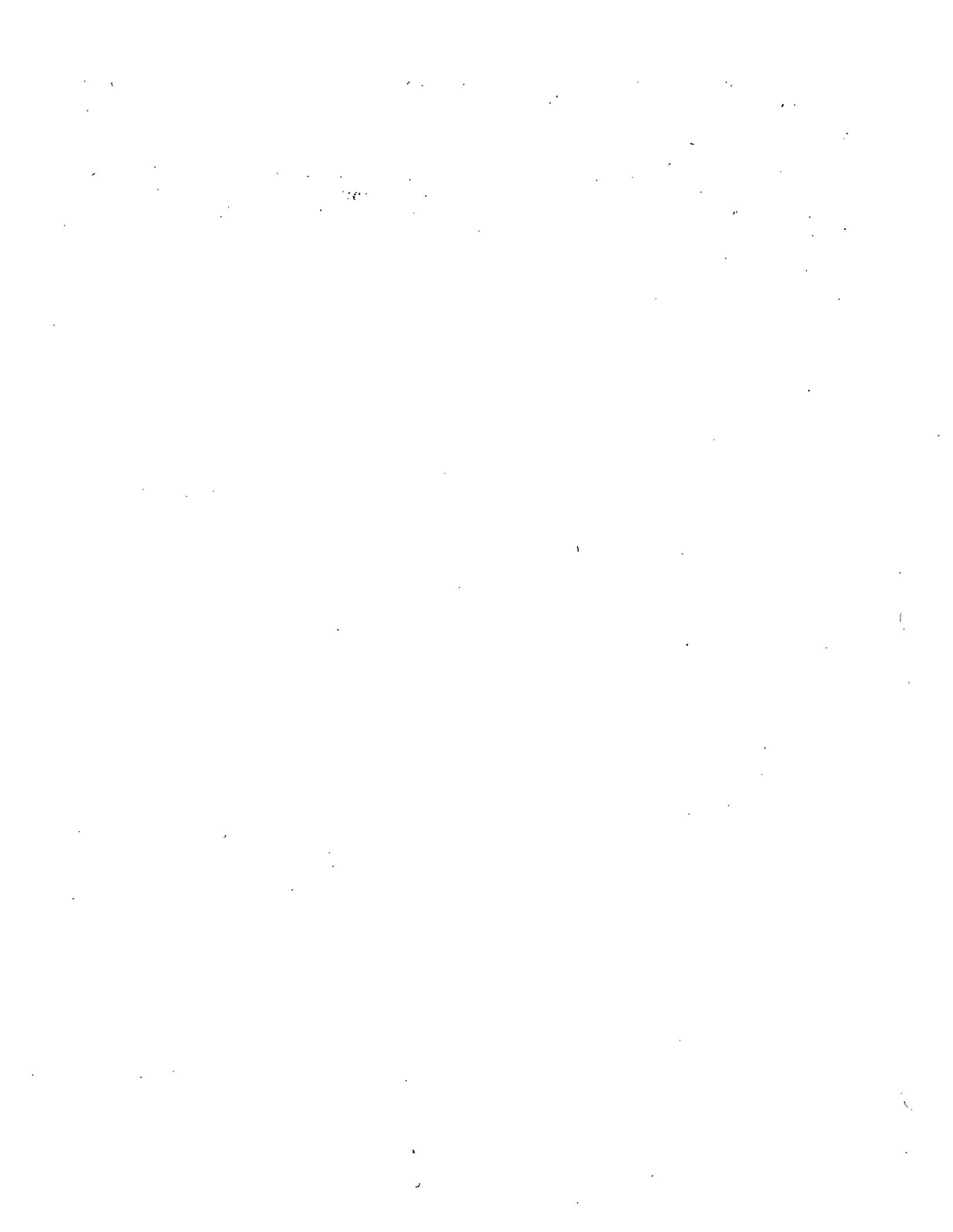
Aggregate shall be measured by the cubic yard in vehicles at the point of delivery on the site.

The measurement for payment may be by the square yard of the surface on which the "seal coat" surface treatment is actually applied.

#### **VI. PAYMENT**

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" shall be paid for at the unit price bid for "Seal Coat", which price shall be full compensation for cleaning and sprinkling the base; for furnishing, freight involved, preparing, hauling, and placing all materials, and for all manipulations, labor, tools, equipment, and incidentals necessary to complete the work.

**LAST PAGE OF THIS SUBSECTION**



**SUBSECTION 4.12  
TWO COURSE SEAL COAT  
(SMALL AGGREGATE)**

**I. SCOPE**

This item includes a wearing surface composed of two (2) applications of asphalt, each covered with aggregate constructed on a prepared base course or existing surface.

Neither course shall be applied when the air temperature is below sixty (60°) F. The temperature shall be taken in the shade and away from artificial heat. No asphalt shall be placed when general weather conditions are not suitable.

**II. MATERIAL**

**A. Asphalt:** Asphalt shall conform to requirements as specified in Item 4.11 "Seal Coat (Small Aggregate)."

**B. Aggregate:** The aggregate shall be composed of sound and durable particles of gravel or stone having a percent of wear of not more than 35 according to AASHTO T-96. It shall be free from organic matter, clay, loam, or pebbles coated therewith and shall not contain more than five (5) percent of slate, shale, schist, or soft particles of sandstone. When tested by laboratory methods, it shall meet the grading requirements specified below:

**First Course Aggregate**

Retained on 5/8" sieve . . . . .	0%
Retained on 1/2" sieve . . . . .	0-2%
Retained on 3/8" sieve . . . . .	20-35%
Retained on No. 4 sieve . . . . .	95-100%
Retained on No. 10 sieve . . . . .	99-100%

**Second Course Aggregate**

Retained on 1/2" sieve . . . . .	0%
Retained on 3/8" sieve . . . . .	0-5%
Retained on No. 4 sieve . . . . .	40-85%
Retained on No. 10 sieve . . . . .	98-100%
Retained on No. 20 sieve . . . . .	99-100%

**III. EQUIPMENT**

The equipment requirements of Subsection 4.13 "Hot Mix Asphaltic Concrete" shall apply.

**IV. CONSTRUCTION METHODS**

**A. Construction Methods** shall conform to the applicable sections of Subsection "4.11 Seal Coat (Small Aggregate)."

**B. Asphalt** for the first course shall be applied on the clean surface by an approved type of self-propelled pressure distributor so operated as to distribute the material in the quantity specified, evenly and smoothly, under a pressure necessary for proper distribution. The Contractor shall provide all necessary facilities for determining the temperature of the asphalt in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of

two distributor loads. The asphalt shall be covered with first course aggregate by an approved spreader. The course shall be rolled and the second application of asphalt shall be made in the manner specified for the first application. The second application shall be covered with second course aggregate, and the entire surface shall be thoroughly rolled with an approved self-propelled roller. This rolling shall continue as necessary to imbed the aggregate. The asphalt and aggregate shall be applied at the approximate rates indicated on the following schedule.

Application	Gallons of Asphalt Per Sq. Yd.		Aggregate Cu. Yds. to Sq. Yd.	
	Min.	Max.	Min.	Max.
First	.025	0.30	1:110	1:90
Second	0.35	0.40	1:150	1:125

The Contractor shall maintain the surface until accepted by the Engineer.

#### V. MEASUREMENT

- A. Asphalt shall be measured in gallons at the applied temperature.
- B. Aggregate shall be measured by the cubic yard in vehicles at the point of delivery on the site.
- C. The measurement for payment may be by the square yard of the surface on which the double bituminous surface treatment is actually applied.

#### VI. PAYMENT

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" shall be paid for at the unit price bid for "Two Course Seal Coat", which price shall be full compensation for cleaning, and sprinkling the base or existing surface; for furnishing, freight involved, preparing, hauling, and placing materials and all incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION

**SUBSECTION 4.13  
HOT-MIX ASPHALTIC CONCRETE**

**I. SCOPE**

This item includes a base course, a leveling-up course, a surface course or any combination of these courses as shown on the plans. Each course 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, or prepared concrete slab and in accordance with the project plans.

Unless otherwise specified on the project plans, materials and proportions of hot-mix asphaltic concrete pavement used in construction under this item shall conform to these requirements.

**II. MATERIALS**

**A. Mineral Aggregate:** The mineral aggregate shall be composed of a coarse aggregate and a fine aggregate, and if required, a mineral filler. Samples of coarse aggregate, fine aggregate, and mineral filler shall be submitted for approval of materials and their sources prior to delivery.

In lieu of initial testing, test results from other projects may be submitted. The submitted test results shall not be over one year old from this project bid date, otherwise the materials shall be tested. The test results must be received prior to hot-mix asphaltic concrete placement. The combined aggregate sand equivalent value shall be not more than forty-five (45) when tested in accordance with Test Method TxDOT-203-F.

**1. Coarse Aggregate:** The coarse aggregate shall be the aggregate retained on a No. 10 mesh sieve; shall consist of clean, tough, durable fragments of stone, or gravel, of uniform quality and be practically free from clay, organic, or other injurious matter occurring either free or as coating on the aggregate. Material removed by decantation (Test Method TxDOT-217-F) shall not be more than two (2) percent. The coarse aggregate shall have an abrasion of not more than forty (40) when subjected to the Los Angeles Abrasion Test (Test Method TxDOT-410-A).

Unless otherwise shown on the project plans, gravel shall be crushed to have a minimum of eight-five (85) percent of the particles retained on the No. 4 sieve with more than one crushed face, as determined by Test Method TxDOT-413-A (Particle Count).

**2. Fine Aggregate:** The fine aggregate shall be the aggregate passing the No. 10 mesh sieve and shall consist of sand or stone screenings or a combination of sand and stone screenings. Sand shall be composed of sound, durable stone particles free from injurious foreign matter. Screenings shall be of the same or similar material as specified for coarse aggregate. The plasticity index of that part of the fine aggregate passing the No. 40 sieve shall exceed six (6) when tested by Test Method TxDOT-106-E.

**3. Mineral Filler:** The mineral filler shall consist of thoroughly dry stone dust, Portland cement, or other approved mineral dust. The mineral filler shall be free from foreign and other injurious matter when tested by the method outlined in TxDOT Bulletin C-14. It shall meet the following grading requirements:

	Percent by Weight
Passing a No. 30 sieve . . . . .	95 to 100
Passing a No. 80 sieve . . . . .	75
Passing a No. 200 sieve . . . . .	55

**B. Asphaltic Materials:**

1. **Asphalt for Paving Mixture:** Asphalt for the paving mixture shall be of the types shown in Item 300 Asphalts, Oils, and Emulsions of the latest edition of the TxDOT Standard Specifications and shall meet the requirements contained therein. The various grades of asphalt and mix design test results shall be submitted prior to delivery to the project.

2. **Tack Coat:** The asphaltic material for tack coat shall meet the requirements for emulsified asphalt.

**C. Paving Mixtures:**

1. **Types:** The paving mixtures shall consist of a uniform mixture of coarse aggregate, fine aggregate and asphaltic material. The grading of each constituent of the mineral aggregate shall be such as to produce, when properly proportioned, a mixture, which, when tested in accordance with TxDOT Bulletin C-14, will conform to the following limitations:

**Master Grading  
Percent Passing by Weight or Volume**

Sieve Size	Type				
	A Course Base	B Fine Base	C Coarse Surface	D Fine Surface	F Fine Mixture
1-1/2"	100				
1-1/4"	95-100				
1"		100			
7/8"	70-90	95-100	100		
5/8"		75-95	95-100		
1/2"	50-70			100	
3/8"		60-80	70-85	85-100	100
1/4"					95-100
No. 4	30-50	40-60	43-63	50-70	
No. 10	20-34	27-40	30-40	32-42	32-42
No. 40	5-20	10-25	10-25	11-26	9-24
No. 80	2-12	3-13	3-13	4-14	3-13
No. 200	1-6*	1-6*	1-6*	1-6*	1-6*
VMA % minimum	11	12	13	14	15

\* 2-8 when Test Method TxDOT-200-F, Part II (Washed Sieve Analysis) is used.

2. **Tolerances:** The Engineer may designate the exact grading of the aggregate and asphalt content to be used in the mixture. The paving mixture produced shall not vary

from the designated grading and asphalt content by more than the tolerances allowed herein and shall remain within the limitations of the master grading specified in the submitted mix design. The respective tolerances, based on the percent by weight of the mixture, are listed as follows:

	Tolerance, Percent By Weight
Passing the 1 1/4" sieve to No. 10 sieve . . . . .	plus or minus 5
Passing the No. 40 to No. 200 sieve . . . . .	plus or minus 3
Asphalt, weight . . . . .	plus or minus .5

3. **Extraction Test:** Samples of the mixture when tested, shall not vary from the grading proportions of the aggregate and the asphalt content designated by the Engineer by more than the respective tolerances specified above and shall be within the limits specified for master grading. The mixture shall meet either of the following laboratory densities and stabilities:

**Density, Percent**

<u>Min.</u>	<u>Max.</u>	<u>Optimum</u>
95	99	97

Hveem Stability, Percent

Not less than 35, unless otherwise shown on the plans.

Marshall Stability

Not less than 1200 lbs., unless otherwise shown on the plans

4. If the Marshall Method of asphalt mix design is used, the following criteria shall also apply:

Number of blows to each  
end of specimen 50

	<u>Min.</u>	<u>Max.</u>
Flow	8	16
Air Voids	3	5

Voids in the Mineral Aggregate (VMA) Fig. III-5 of Asphalt Institute Manual MS-2

**III. EQUIPMENT**

A. Contractor shall furnish all machinery, tools, equipment, and qualified equipment operators necessary for the proper prosecution and completion of the work. Failure to comply with the plans, specifications, or instructions of the Project Representative may cause suspension of the work or withholding payments.

All equipment shall be maintained in good repair and operating condition and shall be approved by the Project Representative prior to use.

**B. Compaction Equipment:** Suitable and sufficient compacting equipment shall be provided. Compaction equipment shall be approved types to obtain the required densities and stabilities.

1. **Tamping, Pneumatic Tire, and Flat Wheel Rollers:** The rollers shall comply, where applicable, to the Compaction Equipment portion of Subsection 4.02 "Earthwork."

2. **Tandem Rollers:**

a. **Two-Axle Tandem Roller:** This roller shall be an acceptable power-driven two-axle tandem roller weighing not less than eight (8) tons.

b. **Three-Axle Tandem Roller:** This roller shall be an acceptable power-driven three-axle tandem roller weighing not less than ten (10) tons.

3. **Trench Rollers:** This roller shall be an acceptable power-driven trench roller equipped with sprinkler for keeping the wheels wet and adjustable road wheel so that roller may be kept level during rolling. The drive wheel shall not be less than twenty (20) inches wide.

The roller, under working conditions, shall produce three hundred twenty-five (325) pounds per linear inch of roller width and be so geared that a speed of 1.8 miles per hour is obtained in low gear.

4. **Alternative Equipment:** In lieu of the compaction equipment specified, the Contractor may, operate other compacting equipment that will produce compaction in the same period of time as the specified equipment. If the alternative equipment fails to produce compaction within the same time period as the specified equipment, its use shall be discontinued.

**C. Asphaltic Concrete Equipment:**

1. **Mixing Plants:**

a. **General:** Mixing plants will consistently produce a mixture meeting all of the requirements of this specification.

Mixing plants may be either the weight-batching type, the continuous mixing type or the drum mix type. All types of plants shall be equipped with satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors and shall consist of the specified pieces of equipment.

2. **Weight-Batching Type:**

a. **Cold Aggregate Bin and Proportioning Device:** The number of compartments in the cold aggregate bin shall be equal to or greater than the number of stockpiles of individual materials to be used.

The bin shall be of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent overflow of material of one bin to that of another bin. The proportioning device shall be such as will provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Each aggregate shall be proportioned in a separate compartment.

b. **Dryer:** The dryer shall be of the type that continually agitates the aggregate during heating and in which the temperature can be so controlled that aggregate will not be injured in the necessary drying and heating operations required to obtain a mixture of the specified temperature.

The burner, or combination of burners, and type of fuel used shall be such that in the process of heating the aggregate to the desired or specified temperature, no residue from the fuel shall adhere to the heated aggregate. A continuous recording thermometer shall be provided which will indicate the temperature of the aggregate when it leaves the dryer. The dryer shall be of sufficient size to keep the plant in continuous operation.

c. **Screening and Proportioning:** The screening capacity and size of the bin shall be sufficient to screen and store the amount of aggregate required to properly operate the plant and keep the plant in continuous operation at full capacity.

d. **Aggregate Weigh Box and Batching Scales:** The aggregate weigh box and batching scales shall be of sufficient capacity to hold and weigh a complete batch of aggregate.

e. **Asphaltic Material Bucket and Scales:** The asphaltic material bucket and scales shall be of sufficient capacity to hold and weigh the necessary asphaltic material for one batch.

f. **Mixer:** The mixer shall be of the pug mill type and shall have a capacity of not less than three thousand (3,000) pounds in a single batch. The number of blades and the position of same shall be such as to give a uniform and complete circulation of the batch in the mixer. The mixer shall be equipped with an approved spray bar that will distribute the asphaltic material quickly and uniformly throughout the mixer. Any mixer that segregates the mineral aggregate or does not thoroughly and uniformly mix shall not be used. All mixers shall be provided with an automatic time lock that will lock the discharge doors of the mixer for the required mixing period. The dump door or doors and the shaft seals of the mixer shall be tight enough to prevent the spilling of aggregate or mixture from the pug mill.

### 3. Continuous Mixing Type:

a. **Cold Aggregate Bin and Proportioning Device:** Same as for weight-batching type of plant.

b. **Dryer:** Same as for weight-batching type of plant.

c. **Screening and Proportioning:** Same as for weight-batching type of plant.

d. **Hot Aggregate Bin:** The hot bins shall be so constructed that oversize and overloaded material will be discarded through a discharge chute. Hot bins that become deficient in material shall activate a switch that automatically stops the plant until the proper adjustments are made in the aggregate gates.

e. **Hot Aggregate Proportioning Device:** The hot aggregate proportioning device shall be so designed that when properly operated a uniform and continuous flow of aggregate into the mixer will be maintained.

f. **Asphaltic Material Spray Bar:** The asphaltic material spray bar shall be so designed that the asphalt will spray uniformly and continuously into the mixer.

g. **Asphaltic Material Meter:** An accurate asphaltic material recording meter shall be placed in the asphalt line leading to the spray bar so that the cumulative amount of asphalt used can be accurately determined. Provisions of a permanent nature shall be made for

checking the accuracy of the meter output. The asphalt meter and line to the meter shall be protected with a jacket of hot oil or other approved means to maintain the temperature of the line and meter at near that temperature specified for the asphaltic material. The temperature of the asphaltic material entering the recording meter shall be maintained at plus or minus ten degrees (10°) F. of the temperature at which the asphalt metering pump was calibrated and set.

**h. Mixer:** The mixer shall be of the pug mill continuous type and shall have a capacity of not less than forty (40) tons of mixture per hour. Any mixer that segregates the mineral aggregate or does not thoroughly and uniformly mix shall not be used. The dam gate at the discharge end of the pug mixer and pitch of the mixing paddles shall be so adjusted to maintain a level of mixture in the pug mixer between the paddle shaft and the paddle tips except at the discharge end.

**4. Drum Mix Type:** Unless otherwise shown on the plans, the Contractor may use the drum-mixing process in the mixing of asphaltic concrete material. The plant shall mix aggregates and asphalt in the drum mixer without preheating the aggregates. The plant shall be equipped with satisfactory conveyors, power units, aggregate-handling equipment and feed controls and shall consist of the following essential pieces of equipment.

**a. Cold-Aggregate Bin and Feed System:** The number of compartments in the cold-aggregate bin shall be equal to or greater than the number of stockpiles of individual materials to be used.

The bin shall be of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent overflow of material from one compartment to another. The feed system shall provide a uniform and continuous flow of aggregate in the desired proportion to the drum mixer.

The system shall provide positive weight measurement of the combined cold-aggregate feed by use of belt scales or other approved devices. Provisions of a permanent nature shall be made for checking the accuracy of the measuring device as required. When a belt scale is used, mixture production shall be maintained so that the scale normally operates between fifty (50) percent and one hundred (100) percent of its rated capacity. Belt scale operation below fifty (50) percent of the rated capacity may be allowed by the Engineer if accuracy checks show the scale to meet all requirements, at the selected rate and it can be satisfactorily demonstrated to the Engineer that mixture uniformity and quality have not been adversely affected.

**b. Scalping Screen:** A scalping screen shall be required, unless otherwise shown on the plans, and shall be located ahead of any weighing device.

**c. Asphaltic Material Measuring System:** An asphaltic material measuring device shall be placed in the asphalt line leading to the drum mixer so that the cumulative amount of asphalt used can be accurately determined. Provisions of a permanent nature shall be made for checking the accuracy of the measuring device output. The asphalt measuring device and line to the measuring device shall be protected with a jacket of hot oil or other approved means to maintain the temperature of the line and measuring device near the temperature specified for the asphaltic material. Unless otherwise shown on the plans the temperature of the asphaltic material entering the measuring device shall be maintained at ten degrees (10°) F. of the temperature at which the asphalt measuring device was calibrated and set.

**d. Synchronization Equipment for Feed-Control Systems:** The asphaltic material feed-control shall be coupled with the total aggregate weight measuring device in such manner

as to automatically vary the asphalt feed rate as required to maintain the required proportion.

**e. Drum Mix System:** The drum mix system shall be of the type that continually agitates the aggregate and asphalt mixture during heating and in which the temperature can be so controlled that aggregate and asphalt will not be damaged in the necessary drying and heating operations required to obtain a mixture of the specified temperature. A continuously recording thermometer shall be provided which will indicate the temperature of the mixture as it leaves the drum mixer.

**f. Surge-Storage System:** A surge-storage system will be required when required. It shall minimize the production interruptions during operations and be constructed to minimize segregation. A device such as a gob hopper or other similar approved devices to prevent segregation in the surge-storage bin is required.

**g. Scales:** Scales may be standard platform truck scales, belt scales or other equipment such as weigh hopper (suspended) scales. If truck scales are used, they shall be placed at an approved location. If other weighing equipment is used weight checks by truck scales are required for approval of the other equipment.

**E. Asphaltic Material Heating Equipment:** Asphaltic material heating equipment shall heat the asphaltic material required to the desired temperature. Asphaltic material may be heated by steam coils which shall be absolutely tight. The heating apparatus shall be equipped with a recording thermometer with a twenty-four (24) hour chart that will record the temperature of the asphaltic material at the highest temperature.

**F. Spreading and Finishing Machine:** The spreading and finishing machine shall be of an approved type that produces a surface that meets requirements. When the mixture is dumped directly into the finishing machine, it shall have adequate power to satisfactorily propel the delivery vehicles. The finishing machine shall be equipped with a flexible spring and/or hydraulic type hitch sufficient in design and capacity to maintain contact between the rear wheels of the delivery vehicles and the pusher rollers of the finishing machine while the mixture is being unloaded.

No vehicle which requires dumping directly into the finishing machine and which the finishing machine cannot push or propel will be allowed. Vehicles of the semi-trailer type are specifically prohibited from dumping directly into the finishing machine while in contact with the finishing machine. Vehicles dumping directly or indirectly into the finishing machine shall be so designed and equipped that unloading into the finishing machine can be mechanically and/or automatically operated in such a manner that overloading the finishing machine cannot occur and the required lines and grades will be obtained without resorting to hand finishing.

Automatic screed control is required on all projects. The method for control shall be acceptable prior to any asphaltic concrete being laid on the project.

**G. Alternative Equipment:** When permitted by the Engineer in writing, equipment other than that specified, which will consistently produce satisfactory results may be used.

**H. Straightedges and Templates:** The Contractor shall provide acceptable both ten (10) foot or sixteen (16) foot straightedges, as required, for surface testing. Satisfactory templates shall be provided by the Contractor.

#### IV. CONSTRUCTION METHODS

**A. General:** The prime coat, tack coat, or the asphaltic concrete mixture shall not be placed when the air temperature is below fifty degrees (50°) F. and is falling. They may be placed when the air temperature is above forty degrees (40°) F. and is expected to rise above fifty degrees (50°) F. for a period of four (4) or more hours. The air temperature shall be taken in the shade away from artificial heat. The prime coat, tack coat, or asphaltic mixture shall be placed only when the humidity, general weather conditions, temperature, and moisture condition of the base or foundation are suitable. During the application of tack and/or prime coats, care shall be taken to prevent splattering of adjacent pavement, curb and gutter, and structures.

If the temperature of the asphalt mixture of a load or any part of a load becomes more than thirty degrees (30°) F. less than the selected temperature all or any part of the load may be rejected. Payment will not be made for the rejected material.

**B. Prime Coat:** If a prime coat is required, it shall be applied on flexible or stabilized base at the rate and locations as specified.

Tack coat or asphaltic concrete shall not be applied on a previously primed base material until the primed base has completely cured.

The prime coat also shall not be left uncovered long enough to permit dusting. The prime coat has accumulated an unsatisfactory amount of dust, the base material shall be either re-primed or a tack coat applied.

The prime coat shall be applied by spraying in the amount of not less than 0.20 or not more than 0.50 gallons per square yard of base surface. If the prime shall penetrate the prepared surface of the base to acceptable depth.

**C. Tack Coat:** Before the asphaltic concrete mixture is laid, the surface upon which the tack coat is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat. The tack coat shall be applied with an approved sprayer at a rate not to exceed 0.05 gallon per square yard of surface. Where the mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated by the Engineer. All contact surfaces of curbs and structures, all joints, and in places where the distributor bars cannot reach, will have the tack coat applied by a hand sprayer. Hand spray methods shall give the surface a very light application of the tack coat.

No more tack coat shall be placed than is necessary for a day's operation. All nonessential traffic shall be kept off the tack coat.

Projects with rejuvenating agents may not require a tack coat.

**D. Transporting:** The asphaltic concrete mixture, shall be delivered in clean, tight vehicles. The dispatching of the vehicle shall be arranged so that all material delivered may be placed, and all rolling shall be completed during daylight hours. In cool weather, marginal wind and cloud conditions or for long hauls, canvas covers and insulating of the truck bodies is required when the previously required temperature differential may be exceeded. The inside of the truck body may be given a light coating of oil, lime slurry, or other acceptable material to prevent mixture from adhering to the body.

**E. Placing:** The asphaltic concrete mixture shall be dumped and spread on the approved prepared surface with the specified spreading and finishing machine, in such manner that

when properly compacted, the finished pavement will be smooth, of uniform density and will meet the requirements of the typical cross sections and the surface tests.

When the asphaltic concrete 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 provided a satisfactory surface can be obtained by other approved methods.

Adjacent to flush curbs, gutter, liners, and structures, the surface shall be finished uniformly high so that when compacted it will be slightly above the edge of the curb and flush structure unless otherwise required.

**F. Compacting:** The mixture shall be compressed thoroughly and uniformly with approved rollers. The Contractor may operate other compacting equipment that will produce acceptable compaction. If alternative compaction equipment fails to produce the desired compaction, its use shall be discontinued.

**G. Rolling:** Rolling 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. Alternate trips of the roller shall be slightly different in length. Rolling shall be continued until no further compression can be obtained and all roller marks are eliminated.

The motion of the rollers 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 where required. Any 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. Excess water off the rollers 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. Rolling with the trench-type roller will be required on widening areas in trenches and other limited areas where satisfactory compaction cannot be obtained.

**H. Hand Tamping:** The edges of the placed asphaltic concrete along curbs, headers, and similar structures unaccessible to the roller, or in such positions as will not allow thorough compaction with the rollers, shall be thoroughly compacted with lightly oiled tamps.

**I. Surface Finish:** The pavement surface, after compaction, shall be smooth and true to the established line, grade, and cross section. When tested with a ten (10) foot straightedge placed parallel to the centerline of the roadway or tested by other equivalent and acceptable means the maximum deviation shall not exceed one-eighth (1/8) inch in ten (10) feet. Any point in the surface not meeting this requirement shall be corrected.

**J. Opening to Traffic:** The pavement shall be opened to traffic when safely possible. All construction traffic allowed on pavement open to the public will be subject to the State laws governing traffic.

If the surface ravel, it will be the Contractor's responsibility to correct this condition at his expense.

**K. In-Place Density:** In-place density is required and it is the intent of this specification that the material be placed and compacted to ninety-six (96) percent of the maximum density as determined by ASTM D1559 or as specified on the plans. The maximum density shall be determined from material sampled from the mixing plant and molded in accordance with ASTM D979. Procedures and methods outlined in ASTM D1188 or ASTM D2950 shall

also be used in determining the in-place density. The field specimens utilized for the in-place density testing may be either cores or sections of hot-mix asphaltic concrete tested according to ASTM D1188 or D2950. In-place density tests are intended for control tests. If the in-place density of the mixture produced has a value lower than that specified and in the opinion of the Engineer is not due to a change in the quality of the material, production may proceed with subsequent changes in the mix and/or construction operations until the in-place density equals or exceeds the specified density. Regardless of the method of compaction control followed, all rolling shall be completed before the mixture temperature drops below one hundred seventy-five degrees (175°) F.

#### **V. MEASUREMENT**

Work and accepted material as prescribed for "Hot-Mix Asphaltic Concrete" will be measured by a unit of surface area (square yard or as stated in the proposal) of the hot-mix asphaltic concrete pavement, in place and accepted, for the specified thicknesses.

#### **VI. PAYMENT**

The work performed and materials furnished as prescribed by this item and measured as provided will be paid for at the unit prices bid for "Hot-Mix Asphaltic Concrete" of the thickness specified. The prices shall each be full compensation for quarrying, furnishing all materials, prime coat, tack coat, and freight involved; for all heating, mixing, hauling, cleaning the existing base course or pavement, placing hot-mix asphaltic concrete pavement, rolling and finishing; and for all manipulations, labor, tools, equipment, and incidentals necessary to complete the work.

**LAST PAGE OF THIS SUBSECTION**

**SUBSECTION 4.14  
CONSTRUCTION PAVEMENT MARKINGS**

**I. SCOPE**

This item includes the placement, maintenance, and prompt removal of pavement markings when required during construction operations.

**II. MATERIALS**

The material used in construction areas shall be distinctively visible when dry from a minimum distance of three hundred (300) feet in daylight conditions and a minimum of one hundred sixty (160) feet when illuminated by automobile low-beam headlights at night. Visibilities are to be measured when viewed from an automobile traveling on the roadway.

The day color as well as the nighttime reflected color of the markings shall be distinctly white or yellow as required and shall conform to appropriate color requirements. The markings shall exhibit uniform retroreflective characteristics.

**III. EQUIPMENT**

The Contractor shall use such equipment to properly place the pavement marking materials.

**IV. CONSTRUCTION METHODS**

**A. Placement and Maintenance:** Streets which were closed to traffic during construction should be marked with standard pavement markings in accordance with Texas MUTCD prior to traffic returning. Streets open to traffic during construction shall be properly marked at the end of each day's work in accordance with Texas MUTCD Standards in order to replace those markings that may have been covered or obliterated during the day's operation.

Traffic may be permitted on new pavement surfaces for a period of forty eight (48) hours before markings are required. The Contractor shall maintain markings to the satisfaction of the Project Representative.

The Contractor shall diligently place and maintain the markings as long as they are required for traffic operations through construction areas. Markings which fail to meet these requirements shall be replaced immediately by the Contractor.

**B. Removal:** When construction requires altering of any pavement marking, the Contractor shall provide for the covering or complete obliteration of any conflicting markings. Prior to placement of any marking material that will require subsequent removal during construction, the Contractor will demonstrate the removability of the material to the Project Representative. Removal of the markings shall leave no discernible evidence of the marking ever having been placed.

**V. MEASUREMENT**

Construction Pavement Markings will be measured by a unit as specified in the proposal, complete and in place. Certain projects that require pavement markings may not allow measurement for payment.

**VI. PAYMENT**

The work performed and materials furnished as prescribed by this item, measured as provided under "Measurement", shall be paid for at the unit price bid for "Construction Pavement Markings" of the various sizes, shapes, and colors as specified, which price shall be full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to place, maintain, and remove the markings as required.

**SUBSECTION 4.15  
METAL BEAM GUARD FENCE**

**I. SCOPE**

This item includes furnishing metal beam rail elements supported on timber or steel posts. Metal beam guard fence shall consist of one (1) or more lines of rail element supported on timber or steel posts. Metal beam guard fence shall be constructed of acceptable materials and workmanship at locations and typical details shown on the plans. Where required, the rail element shall be blocked out from the posts with spacers.

**II. MATERIALS**

**A. Rail Elements:** The rail elements shall be of the deep-beam type fabricated to develop continuous beam strength and shall consist of metal plate or sheet formed into a beam not less than twelve (12) inches wide and three (3) inches deep as shown on the plans. The beam shall be free from warp. When tested with a straight edge or string along either edge of the beam, the maximum deviation of the beam edges from the straight edge shall not exceed one-half (1/2) inch at any point.

The steel for the rail elements shall conform to the requirements of AASHTO-M-180. The rail shall be of a ten (10) gauge nominal thickness (0.1345 ± 0.0008 inch).

The rail element may be galvanized before or after fabrication in accordance with the requirements of ASTM A 123 or A 525, whichever is applicable, except that the galvanized coating shall not be less than 1.80 ounces per square foot of double exposed surface (single spot test).

Rail elements shall contain not more than 0.04 percent phosphorous nor more than 0.05 percent sulphur.

When required existing metal beam guard fence rail element will be salvaged by the Contractor. Salvaged rail elements shall not be subject to the above requirements, but shall meet project requirements. Only acceptable rail elements shall be used on projects.

**B. Posts:** The posts shall be either timber or steel as indicated on the plans and proposal and shall meet the following requirements.

**1. Timber Posts:** Timber posts and spacers shall be Southern Yellow Pine. All posts shall be round. Posts shall not be less, in any place, than seven (7) inches in diameter. The diameter shall be determined by means of a circumference-diameter tape. The average diameter at the base of the dome shall not exceed the specified diameter by more than one (1) inch. The diameter at the butt of any post shall not exceed the diameter at the base of the dome of that post by more than two (2) inches. The supplier shall stencil in the butt of each post the nominal diameter of the top seven (7) inches. The stenciled numeral shall be one (1) inch high. The length of the posts shall not vary more than one (1) inch from the specified length. They shall be the length shown on the plans; the bottom and the top shall be fabricated as shown on the plans.

For domed posts, the dome shall be approximately hemispherical in shape and the radius of the dome of each post shall be one-half the diameter of the posts at the base of the domed portion. The dome shall be smooth and the distance from the top of the dome to the base of the dome shall not vary more than 1 inch at any location. For beveled posts, no posts will be accepted with less than a ten degree (10°) bevel. A tolerance of five degrees (+5°) will be permitted. The posts shall be machine peeled and trimmed of all knots and knobs and shall be straight and smooth. The posts and spacers shall be sound and free from defects such as injurious ring shakes, unsound or loose knots, or other defects. Sound knots will be permitted provided they are not in clusters and they do not exceed one-third

(1/3) of the small diameter or least dimensions. Any defect or combination of defects which would be more injurious than the maximum allowable knot will not be permitted. A line drawn from the center of each end of the post shall not fall outside the center of the post at any point more than one to one-fourth (1-1/4) inches.

Timber posts and spacers shall be bored and cut to the dimensions shown on the plans before being treated. They shall be treated with pentachlorophenol treatment, ACA treatment, CCA treatment unless prohibited by applicable State and Federal regulations.

Timber posts shall be treated with proper preservatives at the vendor's mill. If cuts, notches, or holes are made or discovered during the construction, these shall be properly treated in the field, also.

Timber posts and spacers shall be painted with two (2) coats of good quality aluminum paint after the guard fence is erected unless otherwise specified.

When specified timber posts may be furnished to the Contractor by the City of Amarillo. Such posts shall not be subject to the above requirements, but shall meet requirements as directed by the Engineer. Posts furnished and not bored shall be bored by the Contractor. Unless specified otherwise on the plans, posts shall be painted with two coats of good quality aluminum paint after the guard fence is erected.

**2. Steel Posts:** Steel posts and spacers shall be of the rolled sections as shown on the plans. The posts and spacers shall be structural steel conforming to the requirements of ASTM A 36. The top of all posts shall be beveled, or square as required by detail and drilled or punched for bolts for rail attachments.

Steel post and spacers shall be galvanized and shall conform to the requirements of ASTM A 123.

**C. Fittings:** Fittings shall consist of bolts, nuts and washers and shall conform to the details shown on the plans and shall comply with the requirements as specified herein.

All bolts and nuts used shall be made by either the open hearth or electric furnace process and shall conform to the requirements of ASTM A 307. They shall be either hot-dip galvanized to conform to ASTM A 153, Class C or D, or mechanically galvanized to conform to ASTM B 454, Class 40.

Unless otherwise specified, the concrete for terminal anchor posts for embedment of other posts in concrete shall meet the requirements for concrete as specified elsewhere.

The rail element for the terminal anchor section shall be of the same materials as the rail element used throughout the project.

**D. End Shoes:** End shoes, where required, shall conform to the details shown on the plans and to the materials and galvanizing requirements specified for rail elements.

**E. Sampling and Testing:** A sample of the rail and terminal section may be taken for each project or for each shipment to a project. Samples of bolts and nuts may also be required. All samples shall be furnished. The plate or sheet shall be sampled and tested in accordance with the requirements of ASTM E 8. For galvanized articles the weight of coating shall be determined by stripping in accordance with ASTM A 90.

The uniformity of the zinc coating shall be determined by visual inspection. If visual examination is inconclusive, the uniformity of the coating may be determined by magnetic thickness gauge measurement, in accordance with ASTM E 376 or by the Preece test as described in ASTM A 239. When the Preece Test is used, all items designated in

ASTM A 153 as Class B-2, B-3, C and D shall withstand a minimum of four (4) one-minute dips. All other items shall withstand a minimum of six (6) one-minute dips.

### III. EQUIPMENT

The Contractor shall use proper equipment during metal beam guard fence construction.

### IV. CONSTRUCTION METHODS

The posts shall be set plumb and firm to the line and grades. Unless concrete embedment is required, the posts shall be backfilled by thoroughly tamping the material in four (4) inch layers. The rail elements shall be erected to produce a smooth, continuous rail paralleling the line and grade of the street surface. The rail elements shall be joined end to end by bolts and lapped in the direction of traffic in the lane adjoining the guard fence. Holes for special details may be field-drilled or punched.

Driving is acceptable in attaining the established line and grade for posts. A structural-steel driving head suitable for the type and size of post being driven shall be used. Wood cushion blocks shall be used as necessary to prevent damage to posts. Rope mat, belting or other similar cushioning material may be used in addition to wood cushion blocks. Before driving timber posts, the ground adjacent to the post shall be excavated to a depth of six (6) inches below finished shoulder grade, and after placing, each post shall be painted, where required by the plans, from six (6) inches below the ground surface to two (2) inches above, with one brush-coat application of hot asphalt, finished to a neat line at the top. Pilot holes may be required or permitted. The size and depth shall be determined by the Contractor based trial operations. Loosened soil around the post shall be thoroughly tamped and any void between the soil and the post resulting from the driving shall be filled with suitable material and thoroughly compacted.

Where posts are driven, the driving may be performed with approved power or gravity hammers.

Salvaged rail elements shall be thoroughly cleaned by means of steam cleaning, soap and water and rotating brushes, or other means as required to remove all dirt, grease, road oil, etc., from the surface of the rail element.

After erection, all parts of steel posts, spacers, washers, bolts, and rail elements on which the galvanizing has become scratched, chipped, or otherwise damaged shall be thoroughly cleaned by wire brushing the damaged area to remove all loose, cracked or bruised spelter coating. The cleaned area shall be painted with two (2) coats of zinc dust-zinc oxide paint conforming to the requirements of Federal Specification TT-P-641b or shall be repaired by application of galvanizing-repair compounds meeting Federal Specification O-G-93 (Stick only) in accordance with the manufacturer's recommendations.

Where fabrication is done after galvanizing and where required by plans the cut edges and bolt holes shall be cleaned by brushing and the cleaned area shall be painted with two coats of zinc dust-zinc oxide paint conforming to the requirements of the Federal Specification TT-P-641b or shall be repaired by application of galvanizing-repair compounds meeting Federal Specification O-G-93 (Stick only) in accordance with the manufacturer's recommendations.

## **V. MEASUREMENT**

This item will be measured by the linear foot of fence, complete in place, measurement being made upon the face of the rail in place, from center to center of end posts, from terminal-anchor sections, or, in the case of structure-railing connection, from the points shown on the plans.

## **VI. PAYMENT**

The work performed and material furnished as provided under "Measurement", will be paid at the unit price bid for "Metal Beam Guard Fence" of the gauge specified which price shall each be full compensation for furnishing all materials, except salvaged rail elements where specified on the plans and timber for all posts furnished, including necessary boring for preparation, hauling and erection and painting of same; for setting posts in concrete when specified, and spacers where required and for all labor, tools, equipment and incidentals necessary to complete the work, including driving posts, excavating, backfilling and disposing of surplus material.

**LAST PAGE OF THIS SUBSECTION**

## SUBSECTION 4.16 PLANING ASPHALTIC CONCRETE SURFACE

### I. SCOPE

This item includes scarifying and planing the existing asphaltic concrete pavement and asphalt-stabilized base for the depths indicated on the plans and stockpiling of the scarified materials at the designated locations. The planed surface shall provide a smooth riding surface free from gouges, continuous longitudinal grooves, ridges, oil film, and other imperfections of workmanship and shall have a uniform appearance.

### II. MATERIALS

No materials are expected for use by this subsection.

### III. EQUIPMENT

The equipment for removing the pavement surface shall be a power operated planing machine or grinder capable of removing, in one pass, asphaltic concrete pavement of a thickness of three (3) inches and any required thickness less than three (3) inches, in a minimum six (6) foot width. The equipment shall be self propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine by referencing from the existing pavement, curb or profile grade established by the Engineering Department and shall have an automatic system for controlling cross slope at any given rate.

The machine shall be equipped with an integral loading and reclaiming means to immediately remove material being cut from the surface of the roadway and discharge the cuttings into a truck in one operation. Adequate back-up equipment such as mechanical street sweepers, loaders, trucks, and personnel will also be provided to keep airborne particles to a minimum and to insure that all cuttings are removed from the roadway surface daily. Stockpiling of planed material will not be permitted on the project site unless approved by the Project Representative. The machine shall be equipped with means to control airborne particles created by the cutting action. The machine shall have a manual system providing for uniformly varying the depth of cut while the machine is in motion thereby making it possible to cut flush to all inlets, manholes, or other obstructions within the paved area.

Any machine incapable of meeting these requirements will not be permitted. Various machines may be permitted to make trial runs to demonstrate to the Engineer the capabilities of that machine.

### IV. CONSTRUCTION METHODS

The pavement surface shall be removed to the depth, width, grade and cross section as required.

The pavement planing operation shall be referenced from an independent grade control in areas deemed appropriate by the Engineer. For this operation, the independent grade control shall be established and maintained by the Contractor in an acceptable manner and the final position of same shall be acceptable to the Engineer.

If the entire pavement width or traveled lane width along a section of street has not been planed to a flush surface by the end of a work period resulting in a vertical or near vertical longitudinal face exceeding one and one-fourth (1 1/4) inches in height, this longitudinal

face shall be sloped to not create a hazard to traffic. Transverse faces that are present at the end of a working period will be tapered to avoid creating a hazard for traffic.

The cuttings or loose material resulting from the planing operation shall remain the property of the City and the Contractor shall stockpile the material at designated locations. Salvaged material shall be kept as free as possible from contamination by nonasphaltic materials during its removal, transportation, and storage. Placement methods at stockpiles shall be approved by the Project Representative. Salvaged asphaltic paving materials of differing type or quality may require separate stockpiling.

When located within four (4) inches of steep curbs, asphaltic concrete and/or asphalt-stabilized base that cannot be removed by the planing machine shall be removed by other acceptable methods and the pavement and curb surfaces shall be cleaned of all debris and left in a neat and presentable condition.

In planed areas where traffic is permitted, "Grooved Pavement Ahead" signs shall be erected at an appropriate distance ahead of the planed areas and at a maximum spacing of one-half (1/2) mile within the planed area. Signs shall be erected prior to planing in the areas and shall be maintained in place until the planed area is overlaid. Signs shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways" and "Standard Highway Sign Designs for Texas." After planed areas are overlaid, the Contractor shall remove these signs.

#### V. SURFACE

In areas where traffic is permitted, a texture shall be produced which shall be a grid pattern with uniform discontinuous longitudinal striations, or any other pattern with discontinuous longitudinal striations that provide a satisfactory riding surface.

Unless otherwise directed, the grade reference used by the Contractor may be of any approved type. Control points, when applicable, will be established for the finished grade by the Engineer. These points will be set at intervals not to exceed fifty (50) feet. The Contractor shall set the grade reference for the sensor of the automatic control to follow from the control points established by the Engineer. This grade reference shall have sufficient support so that the maximum deflection shall not exceed one-sixteenth (1/16) inch per twenty-five (25) feet.

The surface of the pavement after planing shall be smooth and true to the established line, grade and cross section. When tested with a ten (10) foot straightedge placed parallel to the centerline of the roadway or tested by other equivalent or acceptable means, the maximum deviation shall not exceed one-eighth (1/8) inch in ten (10) feet. Any point in the surface not meeting this requirement shall be corrected.

#### V. MEASUREMENT

Work prescribed by this item will be measured by the square yard of surface area for the various depths shown on the plans or as described in the proposal.

Measurement will be based on the depth shown for each bid item, within the limits shown on the plans, regardless of the actual thickness removed or the number of passes required. Only one bid item will be applicable to any one location.

Square yard calculations will be based on the neat dimensions shown on the plans.

Measurement will be made only one time for each depth regardless of the number of passes required to be made by the machine in order to secure the depth desired.

Tapering or sloping of longitudinal or transverse joints (faces) as described under "Construction Methods" will not be measured for payment.

#### VI. PAYMENT

The work performed as prescribed by this item, measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Planing Asphaltic Concrete Surface" of the various depths shown on the plans, which price shall be full compensation for removing all materials to the depth shown, loading, hauling, unloading, and satisfactorily stockpiling of the material and for all signs and sign removal, labor, tools, equipment, manipulation and incidentals to complete the work.

No payment will be made for work done by any machine on a trial run to demonstrate its ability to meet this specification unless the work is acceptable.



**SUBSECTION 4.17  
MICRO-SURFACING SYSTEM  
(POLYMER MODIFIED)**

**I. SCOPE**

The intent of this bid is to provide for the micro-surfacing of existing streets within the City of Amarillo, in accordance with the following standards, terms, and conditions.

**II. DESCRIPTION**

A. This item shall consist of a micro-surfacing system which shall be a mixture of cationic modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives mixed and spread on the paved surface in accordance with these specifications.

B. All testing required by these special specifications is to be performed using Texas Department of Transportation (TxDOT) testing methods and their bulletins.

C. The term "Engineer" shall refer to the City Engineer or his designee.

**III. MATERIALS**

A. **Asphaltic Materials:** The asphalt material, designed as CSS-1P, shall be a cationic slow setting emulsion modified with an approved polymer. The polymer shall be incorporated by blending with the base asphalt prior to emulsification or it shall be co-milled with the asphalt to produce the finished emulsion. The distillation residue of the modified emulsion shall contain a minimum of 3.0 percent polymer by weight, as determined by an analytical method approved by the Engineer. The emulsion supplier shall furnish the Engineer samples of the base asphalt and polymer used in the finished emulsion.

In addition, the emulsion shall be homogeneous, shall show no separation of polymer and shall comply with the following requirements:

	MINIMUM	MAXIMUM
Viscosity, Saybolt Furol at 77° F, Seconds	20	100
Storage Stability Test, One Day, Percent	--	1
Particle Charge Test	Positive	
Sieve Test, Percent	--	0.1
<b>* Distillation:</b>		
Oil Distillate, by Volume of Emulsion, Percent		90
Residue, Percent	62	--
<b>Tests on Residue from Distillation:</b>		
Penetration, 77° F, 100 g., 5 Seconds	55	90
Ductility, 77° F, 5 cm/min, cm	70	--
Solubility in Trichloroethylene, Percent	97	--
Softening Point, R. & B., F	135	--

\* The standard distillation procedure shall be modified as follows:

The temperature on the lower thermometer shall be brought slowly to 350° plus or minus 10°F and maintained at this point for 20 minutes. Complete the total distillation in 60 plus or minus 5 minutes from the first application of heat.

**B. Mineral Aggregate:** The mineral aggregate shall be composed of clean, tough, and durable particles of crushed traprock, crushed granite, or crushed sandstone, or other material approved by the Engineer. A sand equivalent of 65 or higher is required. The aggregate shall have a weighted loss of not more than 12 percent when sodium sulfate is used or 25 percent when magnesium sulfate is used in accordance with Test Method Tex-411-A.

The polish value for the aggregate shall not be less than 40 when tested in accordance with Test Method Test-438-A. If the traprock is used, the polish value requirement is waived.

1. **Grades:** When tested by Test Method Tex-200-F, Part II, the gradation requirements shall be as follows:

Fine Graded Surface Course	Percent Aggregate Retained by Weight
Passing 3/8" sieve . . . . .	0
Passing No. 4 sieve . . . . .	0-2
Passing No. 8 sieve . . . . .	10-25
Passing No. 16 sieve . . . . .	25-50
Passing No. 30 sieve . . . . .	50-70
Passing No. 50 sieve . . . . .	65-82
Passing No. 100 sieve . . . . .	79-90
Passing No. 200 sieve . . . . .	85-95

2. **Mineral Filler:** Mineral filler shall be non-air-entrained Portland cement which is free of lumps or foreign matter.

**C. Water:** The water shall be potable and shall be free of harmful soluble salts.

**D. Other Additives:** Additives supplied by the emulsion manufacturer may be added to the emulsion mix or to any component materials to provide control of the set time in the field.

**IV. PAVING MIXTURE**

**A. Mixture Design:** The mix shall be designed by the Contractor in accordance with Texas Department of Transportation Bulletin C-14 and Test Method Tex-204-F, using Test Method Tex-227-F to supplement Test Method Tex-201-F and Tex-202-F to conform with the requirements herein. The above laboratory mixing and curing procedures may be modified as approved by the Engineer. The emulsified asphalt content will be selected by the Engineer to provide an optimum laboratory compacted density within the range of 94-97 percent. A minimum HVEEM stability of 35 is required for placement exceeding a depth of twice the maximum aggregate size.

This is a mix design requirement, to be verified by testing of trial batch material prior to placement of project material. HVEEM stability testing will be performed by the Contractor. The frequency of job control density and stability testing will be determined by the Engineer. The Contractor shall be responsible for payment of all testing, prior to materials being placed.

The Contractor shall furnish the mix design for the type of mixture specified together with applicable design worksheets and date. The Bulk Specific Gravity will be determined for each aggregate to be used in the design mixture. If the determined values vary by 0.300 or more, the mixture design will be by the Volumetric Methods, Test Method Tex-204-F, Part II. To substantiate the design, trial mixtures will be produced and tested using all of the proposed project materials and equipment prior to any placement. The Engineer may waive trial mixtures if the same design has been proven to be in conformance with these requirements.

**B. Composition of Mixture:** The Engineer shall approve the design mix and all micro-surfacing materials and methods prior to use and shall designate the proportions to be used within the following limits.

- Residual Asphalt . . .** 6.0 to 9.0 percent by weight of dry aggregate  
or 13.5 to 23 percent volume of the aggregate.
- Mineral Filler . . . . .** 0.5 to 3.0 percent of dry weight of aggregate.  
(Portland Cement)
- Modifier . . . . .** As required to provide the specified properties.
- Water . . . . .** As required to provide proper consistency.

**C. Type:** The paving mixture shall consist of a uniform mixture of coarse aggregate, fine aggregate, and asphaltic material. Mineral filler and/or additives may also be required.

The mixture shall be designed so that the mineral aggregate will produce a gradation which conforms to the limitations for the master grading for the type specified herein. The gradation will be determined in accordance with Test Method Tex-200-F (Washed Sieve Analysis) and shall be based upon aggregate and mineral filler. The amount of asphaltic material shall conform to the limitation for the type specified.

**D. Tolerances:** The aggregate portion of the paving mixture produced shall not vary from the design gradation by more than the tolerances which follow. The material passing the No. 200 sieve is further restricted to conform to the limitations for the master grading for the type specified.

The asphaltic material portion of the paving mixture shall not vary from the design amount by more than the allowed tolerance and is also restricted to conform to the master limits. The methods of test for determining the aggregate gradation and asphalt content of the mixture shall be Test Method Tex-210-F or other methods of proven accuracy.

	Percent by Weight or Volume As Applicable
Passing 3/8" sieve, retained on No. 4 sieve . . . .	Plus or minus 5
Passing No. 4 sieve, retained on No. 8 sieve . . . .	Plus or minus 5
Total Retained on No. 8 sieve . . . . .	Plus or minus 5
Passing No. 8 sieve, retained on No. 16 sieve . . . .	Plus or minus 3
Passing No. 30 sieve, retained on No. 50 sieve . . . .	Plus or minus 3
Passing No. 50 sieve, retained on No. 200 sieve . . . .	Plus or minus 3
Passing No. 200 sieve . . . . .	Plus or minus 2
Asphaltic Material . . . . .	Plus or minus 0.5 by weight or 1.2 by volume

## V. EQUIPMENT

All equipment for the handling of all materials and mixing and placing of the mixture shall be maintained in good repair and operating condition and subject to the approval of the Engineer. Any equipment found to be defective and potentially affecting the quality of the paving mixture will be replaced by the Contractor, at no cost to the City.

This material shall be mixed by a self-propelled micro-surfacing mixing machine which shall be a continuous flow mixing self-contained unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, and water to a revolving multi-blade mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, and water to maintain an adequate supply to the proportioning controls. The machine shall be equipped with self loading devices which provide for the loading of all materials while continuing to lay micro-surfacing, thereby minimizing construction joints.

Individual volume or weight controls for proportioning each material to be added to the mix shall be provided. Each material control device shall be calibrated and properly marked.

The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so the amount of aggregate used may be determined at any time.

The emulsion pump shall be a positive displacement type and shall be equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at any time.

The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray immediately ahead of and outside the spreader box.

The mixing machine shall be equipped with an approved fines feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler. The mixing machine shall have a driver station located on each side.

## VI. STOCKPILING AND STORAGE

**A. Aggregate Storage:** If the mineral aggregates are stored or stockpiled, they shall be handled in such a manner as to prevent segregation, mixing of the various materials or sizes, and contamination with foreign materials. The grading of aggregates proposed for use and as supplied to the mixing plant shall be uniform. Suitable equipment of acceptable size shall be furnished by the Contractor to work the stockpiles and prevent segregation of the aggregates. The mineral aggregate shall be screened prior to being weighed for a job site delivery. This weight shall be done by means of a scale approved by the Engineer.

**B. Storage and Heating of Asphaltic Materials:** The asphaltic material storage shall be ample to meet the requirements of the plant. Asphalt shall not be heated to a temperature in excess of that specified in the TxDot Item "Asphalts, Oils, and Emulsions." All equipment used in the storage and handling of asphaltic material shall be kept in a clean condition at all times and shall be operated in such a manner that there will be no contamination with foreign matter.

**C. Storage Location:** It shall be the responsibility of the Contractor to provide storage locations for materials, at no cost to the City.

## VII. CONSTRUCTION METHODS

**A. General:** It shall be the responsibility of the Contractor to produce, transport, and place the specific paving mixture in accordance with those specifications and as approved by the Engineer.

**B. Weather Limitations:** The material shall be spread only when the atmospheric temperature is at least fifty (50°) degrees F and rising and the weather is not foggy, rainy, or above 90% humidity.

### **C. Surface Preparation:**

1. The area to be sealed shall be thoroughly cleaned of all vegetation, loose aggregate, and soil.
2. Water used shall be applied at a rate to dampen the entire surface without any free flowing water ahead of the spreader box.
3. Any ruts in excess of 1/2" shall be filled using a rut box prior to placing final surface treatment.
4. All manholes and water valves will be covered with plastic prior to placing micro-surfacing.
5. The Contractor shall remove all raised pavement markers in a manner which will protect and ensure no damage to the existing pavement. Any pavement damaged by the Contractor's operations shall be repaired at no cost to the City. Any excess debris shall be removed by the Contractor at no cost to the City.

**D. Spreading Equipment:** The paving mixture shall be spread uniformly by means of a mechanical type squeegee box attached to the mixer, equipped with paddles to agitate and spread the materials throughout the box. A front seal shall be provided to ensure no loss of the mixture at the street contact surface. The rear seal shall act as a final strike-off and shall be adjustable. The mixture shall be spread to fill cracks and minor surface irregularities and leave a uniform skid resistant application of aggregate and asphalt on the surface.

The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The seam where two spreads join shall be neat appearing and uniform.

**E. Notification:** It shall be the responsibility of the Contractor to notify all residents adjacent to the project of micro-surfacing operation and schedules. Such notice shall be given at least 48 hours before the work begins.

**F. Traffic Control:** It shall be the responsibility of the Contractor to provide adequate traffic control measures, such as barricades, flagmen, cones, etc., to protect the uncured micro-surface from all types of traffic and provide traffic safety in the construction area. Advance warning signs and barricades will be necessary. This shall be in accordance with the Texas Manual on Uniform Traffic Control Devices.

Temporary pavement marking of pressure sensitive tape will be provided and installed by the Contractor, at no cost to the Owner, on all streets. Temporary pavement marker tabs may be substituted for pressure sensitive tape at the Contractor's option.

Tape pavement markers will be four feet (4') in length and the maximum distance between markers will be 40 feet (40'). On curved pavement, tape markers will be two feet (2') in length and spaced a maximum of 20 feet (20') between markers.

Temporary pavement marking must be installed as soon as possible, each day, after final surface treatment has been placed. The Contractor shall be responsible for removing temporary pavement marking after permanent marking has been applied.

#### VIII. MEASUREMENT

A. This item shall consist of the square yard surface area quantity of emulsion, aggregate, and additives combined into a "micro-surfacing mixture" layed and accepted in its final position.

#### IX. PAYMENT

A. The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid for "Micro-surfacing", of the grade specified. This price shall be full compensation for furnishing all materials and performing all operations necessary to complete the work.