

**SUBSECTION 4.01
UTILITY CONSTRUCTION IN CITY OF CANYON
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 Canyon that is performing the particular utility construction.

II. MATERIAL

A. Backfill:

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

a. Materials:

- 1) Provide flowable fill containing, at a minimum, cementitious materials and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor's option, and following approval by the design engineer or manager, the City or its engineer. The flowable fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the design engineer or manager, the City or its engineer.
- 2) Portland Cement: ASTM C150, Type 1 or Type 2.
- 3) Fly ash: ASTM C 618, Class C
- 4) Mixing Water: Fresh, clean, and potable.
- 5) Air-Entraining Admixture: ASTM C260.
- 6) Chemical Admixtures: ASTM C494.
- 7) Aggregate: ASTM C33.

b. Flowable fill mixture:

- 1) Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
- 2) Flowable fill shall have a strength of 50 to 100 psi according to ASTM C39 at 28 days after placement.

- 3) Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 1/8 inch per foot of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
- 4) Flowable fill shall have a unit weight of 115 – 145 lbs/cubic foot measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a minimum of 94 lbs/cy.
- 5) Flowable fill shall have an in-place yield of at least 98% of design yield.
- 6) Provide equipment as recommended by the Manufacturer and comply with manufacturer's recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

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" and / or Subsection 10.06 "Structural Portland Cement Concrete".

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

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

E. Asphalt Concrete (cold-mix): The pertinent sections of the TxDOT Standard Specification on Hot-Mix Cold Laid Asphalt Concrete shall apply. The City or its Engineer shall approve the mix design for this material. Asphalt 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, asphalt concrete, and other pavement operations.

IV. CONSTRUCTION REQUIREMENTS

A. Pavement Excavation Permit: Prior to a Contractor 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 City of Canyon Department of Public Works. 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 Department of Public Works and the permit process started within twenty-four (24) hours or the next working day after the excavation has been made.

Applicable sections of the Canyon Municipal Code shall apply to this section.

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 two thousand five hundred (2500) 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. Asphalt 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 fifty degrees (50°) 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 three (3) 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 two thousand five hundred (2500) 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. Asphalt 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 fifty degrees (50°) F. If, due to weather conditions outside of these specifications, the final surface cannot be placed for an extended period of time, the trench cap shall be covered and finished grade shall be restored with sand, flyash base or other material approved by the City or its engineer.

- 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 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 twenty-four (24) hours of completion of utility work.

The concrete for 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 forty degrees (40°) F. and concrete compressive strength shall be more than two thousand five hundred (2500) pounds per square inch in five (5) calendar days.

The final surface shall be placed within five (5) calendar days of trench cap being placed. Asphalt 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. If, due to weather conditions outside of these specifications, the final surface cannot be placed for an extended period of time, the trench cap shall be covered and finished grade shall be restored with sand, flyash base or other material approved by the City or its engineer.

- 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 two thousand five hundred (2500) pounds per square inch in three (3) calendar days.

The final surface shall be placed within three (3) calendar days of trench cap being placed. Asphalt 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. If, due to weather conditions outside of these specifications, the final surface cannot be placed for an extended period of time, the trench cap shall be covered and finished grade shall be restored with

sand, flyash base or other material approved by the City or its engineer.

- 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 City 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 asphalt 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 City shall be removed and properly replaced during acceptable weather conditions. The required trench cap may be constructed of compacted flexible base, or a material approved by the City or its engineer, 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 City of Canyon.

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 Canyon Department, the time limits shall be set on a project by project basis. The Street Superintendent and the respective City of Canyon Department representative shall determine the time limits.

C. Existing Pavement Removal:

- 1. Asphalt 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 furthest 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 furthest 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 Canyon designated locations if not replaced on the project site.
4. **Paver Removal:** The pavers shall be properly removed and stored at City of Canyon 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, at the Contractor's expense.

The maximum allowable trench width shall be the pipe outside diameter plus twenty-four (24) inches unless otherwise approved. The trench walls shall be vertical, unless other excavation methods are approved prior to start of work. Trenches in excess of 5 feet in depth shall be protected per OSHA standards.

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

F. Utility Trench Backfilling: Backfilling shall be accomplished by one of the following methods. The Department of Public Works shall approve what backfilling method shall be used prior to any project construction. The Contractor shall contact the Department of Public Works 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 compacted or 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 until trench settlement is complete.
4. 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, and with paragraph II of this subsection.
6. Other backfill material and methods as specified on individual utility projects are to be approved by the department of Public Works or the City Engineer 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 furthestmost 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 density. 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 two (2) inches 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 Department of Public Works or the City Engineer. 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 asphalt 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, 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 asphalt concrete and the existing pavement shall be filled with a compatible joint sealing material.

The ambient air temperature requirements during concrete (asphalt 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 shall use 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 Canyon 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 Canyon 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 or restored to its original condition, 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 City, 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 Canyon shall be reimbursed by the Contractor.

The Contractor must request, through the Director of Public Works, the closure of 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 Director of Public Works, to deviate from the announced street closing times and notify all City Departments involved and emergency services, if allowed.

All proposed detours shall be approved by the Director of Public Works prior to any construction. The Contractor must submit a detour plan to the Director of Public Works for approval. If the detour includes any dirt or unimproved 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 pavement section along the detour route shall be restored to its condition prior to the traffic detour.

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 Canyon, 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 Canyon improvement project or private development (if managed by a private developer), the work will not be measured for payment. Under the developer's agreement, the City of Canyon may manage contracts for a private development. Under these circumstances, the utility work will be measured according to the developer's plans and specifications.

VI. PAYMENT

If measured for payment, the construction shall be paid for at the specified unit price provided by the Contractor in his bid 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 City, its Engineer, private Owner or Developer, 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 City 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 by the necessary methods. Each layer shall be compacted by rolling until ninety five (95) percent of the specific material's Standard Proctor is obtained.

- C. Water:** The Contractor is responsible for securing all water necessary for construction in accordance with Subsection 3.04 "Requirements for Water Usage", of these specifications.
- D. 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 and at all tie ins to existing pavement and concrete. 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 shall be completed at no additional cost to the City.
- E. 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.
- F. 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.
- G. 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.
- H. 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 or a maximum slope of four to one.

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 four to one from the top of curb unless otherwise shown on the plans.

- I. Disposal of Excess Material:** Excess materials excavated shall be disposed of properly by the Contractor. The disposal location shall be shown or noted on the plans or designated by the City or Owner / Developer. 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, testing, and incidentals necessary to complete the work.

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**SUBSECTION 4.05
FLEXIBLE BASE**

I. SCOPE

This item includes a foundation course for a concrete surface course, an asphalt concrete surface course or other base courses; shall be composed of crushed stone, gravel, or other material approved by the City or its 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 design or City Engineer.

II. MATERIALS

- A.** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the City or its Engineer of the proposed material sources and of changes to material sources. All acceptance testing shall be performed by the contractor prior to the materials being delivered to the project. Additional quality control testing may be performed after delivery to a project at the discretion of the City or its Engineer. See Subsection 3.03, “Project Material Testing” for testing requirements. Use TxDOT, Standard Specification, Tex-100-E, for material definitions.
- B. Aggregate.** Furnish aggregate of the type and grade shown on the plans and conforming to the requirements of Table 1. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1, unless shown on the plans. Grade 1 and Grade 2 are defined as base material. Grade 3 is defined as subbase material.

**Table 1
Material Requirements**

Property	Test Method	Grade 1	Grade 2	Grade 3
Master gradation sieve size (% retained)	Tex -110-E			
2-1/2 in.		-	0	0
1-3/4 in.		0	0-10	0-10
7/8 in.		10-35	-	-
3/8 in.		30-50	-	-
No. 4		45-65	45-75	45-75
No. 40		70-85	60-85	50-85
Liquid Limit, % max.	ASTM D4318	35	40	40
Plasticity index, max.	ASTM D4318	10	12	12
Wet ball mill, % max.	Tex-116-E	40	45	-
Wet ball mill, % max. Increase passing the No. 40 sieve		20	20	-
Magnesium Soundness	ASTM C88	As shown on plans or specified		

C. Material Tolerances. The City or its Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation. When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4. The City or its Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

D. Material Types. Do not use fillers or binders unless approved. Furnish the type specified on the plans in accordance with the following.

- 1. Type A.** Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.
- 2. Type B.** Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.
- 3. Type C.** Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by TxDOT Standard Specification, Tex-460-A, Part I. Blending of 2 or more sources is allowed.
- 4. Type D.** Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in the paragraph "Recycled Material (Including Crushed Concrete) Requirements," and be managed in a way to provide for uniform quality. The City or its Engineer may require separate dedicated stockpiles in order to verify compliance.
- 5. Type E.** As shown on the plans and approved by the City or its Engineer.

E. Recycled Material. Recycled asphalt pavement (RAP) and other recycled materials may be used when shown on the plans. Approval from the City or its Engineer is required to blend 2 or more sources of recycled materials.

1. Limits on Percentage. When RAP is allowed, do not exceed 20% RAP by weight in the blended material, unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans, or approved by the city or its Engineer.

2. Recycled Material (Including Crushed Concrete) Requirements.

- a. Contractor Furnished Recycled Materials.** When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of Table 1 for the grade specified. Certify compliance with TxDOT, DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines," for Contractor furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with TxDOT, Standard Specification, Tex-413-A. For RAP, do not exceed a maximum percent loss from decantation of

5.0% when tested in accordance with TxDOT, Standard Specification, Tex-406-A. Test RAP without removing the asphalt.

b. City of Canyon Furnished Required Recycled Materials.

When the City of Canyon furnishes and requires the use of recycled materials, unless otherwise shown on the plans:

- City of Canyon required recycled material will not be subject to the requirements in Table 1,
- Contractor furnished materials are subject to the requirements in Table 1 and this Item,
- the final product, blended, will be subject to the requirements in Table 1, and
- for final product, unblended (100% City of Canyon furnished required recycled material), the liquid limit, plasticity index, wet ball mill, classification, and compressive strength is waived. City of Canyon-furnished RAP shall be crushed, if needed, so that 100% passes the 2 in. sieve. The Contractor is responsible for uniformly blending the material to meet the percentage required.

c. City of Canyon Furnished and Allowed Recycled Materials.

When the City of Canyon furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of Table 1 and the plans.

3. Recycled Material Sources. City of Canyon-owned recycled material is available to the Contractor only when shown on the plans or approved by the City. Return unused City of Canyon-owned recycled materials to the City of Canyon stockpile location designated by the City or its Engineer unless otherwise shown on the plans. The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Contractor shall remove excess Contractor-owned recycled materials from the project and dispose of them in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with City of Canyon-owned recycled material unless approved by the City or its Engineer.

F. Water: The Contractor is responsible for securing all water necessary for construction in accordance with Subsection 3.04 "Requirements for Water Usage", of these specifications.

G. Material Sources. When non-commercial sources are used, expose the vertical faces of all strata of material proposed for use. Secure and process the material by successive vertical cuts extending through all exposed strata, when directed.

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 ninety-eight (98) percent of Standard Proctor density. The moisture content shall not be below nor be more than two (2) percent above the 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, one test shall be made for each 300 square yards or fraction thereof, by the contractor, at locations selected 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 ninety-eight (98) 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. In no case shall the final surfacing be placed sooner than twenty-four (24) hours after application of the 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, testing, and incidentals necessary to complete the work.

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**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 and to the dimensions as called for in the contract documents.

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 City or its Engineer, and shall assume all additional costs incurred by his use of a different cement type. 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. 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, an 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 3,500 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 approved 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 three (3) and six (6) 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, and admixtures containing calcium chloride, shall not be permitted.
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." Use of pozzolanic admixtures will not be allowed unless written approval is received from the City or its Engineer.

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. Reinforcing Steel:

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 design or City Engineer. 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 ± 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. 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 approved expansion joint material to the level of the top surface of the slab. Any damage to an existing improvement caused by the Contractor shall be repaired.

Excess subgrade material generated from excavation shall be removed from the site and disposed of at a location specified or shown on the plans or approved by the City or its Engineer.

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 broom 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 shown on the plans or specified.

Concrete shall be deposited so that minimum rehandling occurs and shall 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 Engineer.

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.

**MAXIMUM ALLOWABLE CONCRETE TEMPERATURE
FAHRENHEIT**

		Allowable Concrete Temperature				
Air Temperature	Relative Humidity	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

- F. Sidewalks:** All sidewalks and step treads shall have a minimum transverse slope of one eighth (1/8) inch per foot and a maximum transverse slope of quarter (1/4) 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, unless approved by the City or its Engineer.

- G. Expansion Joints and Scoring:** Expansion joints shall be placed at intervals not to exceed forty (40) 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 joint material shall also be placed around all obstructions protruding through sidewalks or driveways.

All expansion joints for curb and gutter shall be premoulded expansion joint material 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 gutter, face and the top of the curb. 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 design Engineer shall provide horizontal control with a minimum of two control points and vertical control with one benchmark. These points shall be in close proximity to the project. These control points are to be preserved by the Contractor, and shall be replaced at the Contractor's expense, if disturbed or knocked out.

The Contractor shall provide the construction staking. The contractor shall employ an experienced surveyor, approved by the City Engineer, to stake the project. The construction staking as defined below along with all other significant features shall be staked and cut/fill sheets shall be provided to the Design Engineer, City Engineer and affected utilities. A staked point generally shall consist of a wooden hub, and a wooden guard stake or a wooden lathe. Some points may require a tack point. The station of the point staked shall be clearly labeled on the guard stake or lathe. Plastic flagging of the appropriate color shall be provided on the guard stake or lathe. The guard stake or lathe and the hub shall be painted the appropriate color. It is the responsibility of the contractor to make certain all points necessary for construction are in place and to replace those points which have been disturbed or knocked out.

At a minimum, stakes shall be set on an offset, at a convenient distance as to not be disturbed, on each side of the proposed facilities as follows:

1. At 50 foot intervals in straight line grade and alignment sections;
2. At 25 foot intervals in vertical curve sections;
3. At an interval approved by the City Engineer in horizontal curve sections;
4. At all changes in alignment and grade, including all PT's, PC's, and PT's;
5. At all structures and other such constructed features.

Dimensions from property lines and/or easements lines should be maintained. Stationing is normally to be modified to maintain the proper distance from property lines and/or easement lines. Contractor shall notify the design Engineer of any discrepancies for clarification prior to construction.

Cut/fill sheets prepared by the contractor shall be provided to the design and / or City Engineer at least seven working days prior to the start of construction. No construction work shall be performed by the contractor prior to the approval of the cut/fill sheets.

All forms for concrete work shall be inspected and checked by the design Engineer, the City or its Engineer to insure their compliance with established lines and grades before any concrete is poured. The Contractor shall notify the appropriate inspection entity at least twenty-four hours prior to pouring of any concrete to have forms checked. No concrete is to be poured until the forms, foundation conditions, amount, size, and location of reinforcement, have been checked and approved by the appropriate project representative.

- 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 concrete work 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 new concrete to the property line. Backfill between the new work 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 newly placed concrete until sufficient curing time has elapsed.

Only damage of a very minor nature shall be repaired by approved patching. Any substantial damage to the concrete is cause for rejection of that section of the work 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 City or its Engineer. The City or its Engineer will make the final determination of the need for removal or repair.

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 construction layout, 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, testing, and incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION

**SUBSECTION 4.10
MILLING, HEATER-SCARIFICATION, REJUVENATION
AND HOT-MIX ASPHALT 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 asphalt concrete overlay for streets as detailed on the project plans.

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

II. MATERIALS

- A. Asphalt Concrete Rejuvenating Agent:** The rejuvenating agent shall be "Reclamite" as manufactured by the Witco Company or approved equal.
- B. Asphalt Concrete:** The hot mix asphalt concrete shall comply with Subsection 4.13 "Hot Mix Asphalt 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 or specifications 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 City or their authorized 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 if the City or its 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 City or its Engineer. 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 City or its Engineer. The liquidated damages shall be charged for the period from the first day of abandonment. Any delay for utility relocations and/or adjustments authorized by the City or its Engineer shall cancel liquidated damages on a particular street. When Contractor abandonment exceeds more than fifteen (15) working days, the liquidated damages increase to four hundred dollars (\$400) per day.

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

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

The temperature of any surface that the asphalt concrete is to be laid upon shall be equal to or above fifty degrees (50°) F. The surface shall be clean and no runoff water shall be present. The equivalent air temperature as determined by the wind chill factor shall not be below forty degrees (40°) 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, along the edge of valley gutters and any adjoining concrete surface 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 two (2) feet. The design intent is to have a minimum depth of one (1) inch for the new asphalt concrete or a total of two (2) inches at the toe of gutter unless a different depth is specified.

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

Where the proposed overlay abuts existing asphalt concrete pavement, the joint shall be scored and cut smooth and prepared in a manner similar to toe of gutter joints. Joints shall not be trimmed more than five (5) working days prior to the overlay of said pavement. The tapering of the asphalt joints shall be done in a minimum of ten (10) feet or as approved by the Engineer. At Portland cement concrete valleys, the existing asphalt concrete surface shall be trimmed or milled on each side of the valley to allow a smooth 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 City or its Engineer 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 may be required. The milling shall provide proper drainage away from islands and medians.

- C. Heating and Scarifying:** The existing asphalt 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 Asphalt Concrete Overlay:** Following application of the rejuvenating agent, or tack coat, the entire pavement surface shall be overlaid with Class A, Type D hot-mix asphalt concrete in accordance with Subsection 4.13 "Hot-Mix Asphalt Concrete." The hot-mix asphalt concrete overlay shall be placed with a self-propelled spreading and 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 two (2) inches of compacted material. The compacted thickness of the new asphalt concrete overlay shall be a minimum of one (1) inch. Probe or core tests into the completed surface may be required to determine thickness of the new overlay and scarified material. Tests for thickness will be performed for every five thousand

square yards or portion thereof, by the contractor, at randomly selected locations chosen by the City or its Engineer.

The Contractor shall coordinate his overlay operations on each street to allow the immediate striping of each completed street.

- G. Concrete and Paving Repair prior to Heating and Scarification:** All applicable Subsections of the City of Canyon 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 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 the 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 asphalt 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 asphalt 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 shall be measured for payment as two separate items. The first bid item shall be for the linear 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 asphalt 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 City or its Engineer when existing base material is exposed.

All temporary markings and striping shall not be measured and payment shall be made as a lump sum according to the bid proposal.

VI. PAYMENT

The Contractor shall furnish all labor, materials, equipment, tools, testing, manipulation, and subsidiary and incidental items as necessary to provide surface preparation, heating, scarifying, treatment with rejuvenating agent, prime coat, tack coat, compaction, and overlaying of various existing asphalt concrete street surfaces. The unit prices bid shall be full compensation for the above described construction.

The unit price for trimming, milling, joint preparation abutting existing pavement, leveling work, and all other methods of joint preparation or construction shall be full compensation for the completion of the pavement joints in linear feet (based on a two foot minimum width), excluding the hot mix for the final surface.

Prime coat, tack coat or rejuvenating agent as stated in the project proposal will be paid for in gallons, where applicable.

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, testing, and necessary labor for removal and replacement of all concrete work in a workmanlike manner.

The unit price bid for asphalt concrete paving removal and replacement, where applicable, will be full compensation for neat cut of asphalt surface, asphalt paving removal and its replacement, otherwise known as "hot mix patching".

LAST PAGE OF THIS SUBSECTION

SUBSECTION 4.13 HOT-MIX ASPHALT 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 or specified. Each course is to be composed of a compacted mixture of mineral aggregate and asphalt 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 and specifications.

Unless otherwise specified on the project plans, materials and proportions of hot-mix asphalt 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 the project bid date, otherwise the materials shall be tested. The test results must be received prior to hot-mix asphalt concrete placement and shall be from a TxDOT approved source. 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 shall meet the requirements as shown in Aggregate Quality Requirements Table.

Aggregate Quality Requirements

Property	Test Method	Requirement
Coarse Aggregate		
Deleterious material % max	Tex-217-F, Part I	1.5
Decantation, % max	Tex -217-F Part II	1.5
Micro-Deval abrasion, % max	Tex -416-A	Note 1
Los Angeles abrasion, % max	Tex-410-A	40
Magnesium sulfate soundness, 5 cycles, % max	Tex-411-A	30 ²
Coarse aggregate angularity, 2 crushed faces, % min	Tex-460-A Part 1	85 ³
Flat and elongated particles @5:1 % max	Tex-280-F	10
Fine Aggregate		
Linear shrinkage, % max	Tex-107-E	3
Combined Aggregate⁴		
Sand equivalent, % min	Tex-203-F	45

1. Not used for acceptance purposes. Used by the Engineer as an indicator of the need for further investigation.

2. Unless otherwise shown on the plans.

3. Unless otherwise shown on the plans. Only applies to crushed gravel.

4. Aggregates, without mineral filler, RAP, or additives, combined as used in the mix design (job-mix formula (JMF)).

- 2. Fine Aggregate:** Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table below. Supply fine aggregates that are free from organic impurities. The contractor shall provide test results in accordance with Tex-408-A to insure the material is free from organic impurities. At most 15% of the total aggregate may be field sand or other uncrushed fine aggregate. With the exception of field sand, use fine aggregate from coarse aggregate sources that meet the requirements shown in the Table above, unless otherwise approved. If 10% or more of the stockpile is retained on the No. 4 sieve, test the stockpile and verify that it meets the requirements in the Table above for coarse aggregate angularity (Tex-460-A) and flat and elongated particles (Tex-280-F).

Gradation Requirements for Fine Aggregate

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70-100
#200	0-30

- 3. Mineral Filler:** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, cement, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Do not use more than 2% hydrated lime or cement, unless otherwise shown on the plans. The plans may require or disallow specific mineral fillers. When used, provide mineral filler that:
- is sufficiently dry, free-flowing, and free from clumps and foreign matter;
 - does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
 - meets the gradation requirements in the following Table.

Gradation Requirements for Mineral Filler

Sieve Size	% Passing by Weight or Volume
#8	100
#200	55-100

B. Asphalt 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 of the paving mixture to the project.
- 2. Tack Coat:** The asphalt material for tack coat shall meet the requirements for emulsified asphalt as shown in Item 300 Asphalts, Oils, and Emulsions of the latest edition of the TxDOT Standard Specifications.

C. Paving Mixtures:

- 1. Design Requirements.** Use a Level II specialist certified by the Texas Department of Transportation approved hot-mix asphalt certification program, to develop the mixture design. Have the Level II specialist sign the design documents. Unless otherwise shown on the plans, use the typical weight design example given in Tex-204-F, Part I, to design a mixture meeting the requirements listed in these specifications. Furnish the design or City Engineer with representative samples of all materials used in the mixture design.

The City Engineer may verify the mixture design. If the design cannot be verified by the City Engineer, furnish another mixture design. The Contractor may submit a new mixture design at anytime during the project. The City or its Engineer will approve all mixture designs before the Contractor can begin production. Provide the City or its Engineer with a mixture design report. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level II person or persons who performed the design;
- the date the mixture design was performed

2. **Types:** The paving mixtures shall consist of a uniform mixture of coarse aggregate, fine aggregate and asphalt material. The grading of each constituent of the mineral aggregate shall be such as to produce, when properly proportioned, a mixture, which, when tested, 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"	98.0-100.0	-	-	-	-
1"	78.0-94.0	98.0-100.0	-	-	-
3/4"	64.0-85.0	84.0-98.0	95.0-100.0	-	-
1/2"	50.0-70.0	-	-	98.0-100.0	-
3/8"	-	60.0-80.0	70.0-85.0	85.0-100.0	98.0-100.0
No. 4	30.0-50.0	40.0-60.0	43.0-63.0	50.0-70.0	80.0-86.0
No. 8	22.0-36.0	29.0-43.0	32.0-44.0	35.0-46.0	38.0-48.0
No. 30	8.0-23.0	13.0-28.0	14.0-28.0	15.0-29.0	12.0-27.0
No. 50	3.0-19.0	6.0-20.0	7.0-21.0	7.0-20.0	6.0-19.0
No. 200	2.0-7.0	2.0-7.0	2.0-7.0	2.0-7.0	2.0-7.2
Design VMA, % Minimum					
-	12.0	13.0	14.0	15.0	16.0
Plant-Produced VMA, % Minimum					
-	11.0	12.0	13.0	14.0	15.0

Laboratory Mixture Design Properties

Property	Test Method	Requirement
Target laboratory-molded density, %	Tex-207-F	96.0 ¹
Tensile strength (dry), psi (molded to 93% ±1% density)	Tex-226-F	85-200 ²
Boil test ³	Tex-530-C	-

1. Unless otherwise shown on the plans.
2. May exceed 200 psi when approved and may be waived when approved.
3. Used to establish baseline for comparison to production results. May be waived when approved.

3. **Tolerances:** The design or City 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:

Operational Tolerances

Description	Test Method	Allowable Difference from JMF Target
Individual % retained for #8 sieve and larger	Tex-200-F or Fex-236-F	±5.0 ¹
Individual % retained for sieves smaller than #8 and larger than #200		±3.0 ¹
% passing the #200 sieve		±2.0 ¹
Asphalt content, %	Tex-236-F	±0.3 ¹
Laboratory-molded density, %	Tex-207-F	±1.0

1. When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the percent passing the #200 sieve will be considered out of tolerance when outside the master grading limits.

4. **Stability:** The mixture shall meet either of the following laboratory densities and stabilities:

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

5. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. The design or City Engineer may suspend production for noncompliance with this Item. Take corrective action and obtain approval from the Engineer to proceed after any production suspension for noncompliance.

- a. **Operational Tolerances.** During production, do not exceed the operational tolerances listed in the Table above. Stop production if testing indicates tolerances are exceeded on:

- 3 consecutive tests on any individual sieve,
- 4 consecutive tests on any of the sieves, or
- 2 consecutive tests on asphalt content.

Begin production only when test results or other information indicate, to the satisfaction of the Engineer, that the next mixture produced will be within tolerances shown in the Table above.

b. Storage and Heating of Materials. Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions" of the TxDOT Standard Specifications or outside the manufacturer's recommended values. Unless otherwise approved, do not store the mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hours.

c. Mixing and Discharge of Materials. Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F. Mixture heated above 350°F will not be accepted and shall not be placed. Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant.

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 and specifications 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, with 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. Asphalt Concrete Equipment:

1. Mixing Plants:

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. Asphalt Material Bucket and Scales:** The asphalt material bucket and scales shall be of sufficient capacity to hold and weigh the necessary asphalt 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 asphalt 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. **Asphalt Material Spray Bar:** The asphalt material spray bar shall be so designed that the asphalt will spray uniformly and continuously into the mixer.
- g. **Asphalt Material Meter:** An accurate asphalt 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 asphalt material. The temperature of the asphalt 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 asphalt 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. Asphalt Material Measuring System:** An asphalt 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 asphalt material. Unless otherwise shown on the plans the temperature of the asphalt 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 asphalt 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. Asphalt Material Heating Equipment:** Asphalt material heating equipment shall heat the asphalt material required to the desired temperature. Asphalt 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 asphalt 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 appropriate semi-trailer type will be allowed to dump directly into the finishing machine if approved by the City or its Engineer. 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 approved by the Engineer 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 asphalt concrete mixture shall not be placed when the surface temperature is less than fifty degrees (50°) F and the air temperature is below fifty degrees (50°) F. and is falling. They may be placed when the surface temperature is above (50°) F and 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 surface and air temperatures shall be taken in the shade away from artificial heat. The prime coat, tack coat, or asphalt 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 asphalt 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. If 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 the amount of not less than 0.20 or not more than 0.50 gallons per square yard of base surface. The prime shall penetrate the prepared surface of the base to an acceptable depth.

C. Tack Coat: Before the asphalt 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 residual asphalt 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 applied than is necessary for a day's hot mix operation. All nonessential traffic shall be kept off the tack coat.

Projects with rejuvenating agents may not require a tack coat.

D. Transporting: The asphalt concrete mixture, shall be delivered in clean, tight vehicles. The dispatching of the vehicles shall be arranged so that all material delivered may be placed, and all rolling shall be completed during daylight hours. In cool weather, marginal wind and cloud conditions or for long hauls, canvas covers and insulating of the truck bodies are 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 asphalt 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 hot mix is placed in windrows, operate windrow pickup equipment so that substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

When the asphalt 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. Minimum Mixture Placement Temperatures. Use Table below for suggested minimum mixture placement temperatures.

Suggested Minimum Mixture Placement Temperature

High-Temperature Binder Grade	Minimum Placement Temperature (Before Entering Paver)
AC 10 or AC 20	250°F
PG 64 or lower	260°F
PG 70	270°F
PG 76	280°F
PG 82 or higher	290°F

G. 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.

- H. 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.

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

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise approved. If necessary, sprinkle the finished mat with water or limewater to expedite opening the roadway to traffic.

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

- L. Air Voids.** Use air void control unless ordinary compaction control is specified on the plans. Avoid displacement of the mixture. If displacement occurs, correct to the satisfaction of the Engineer.
- 1. Air Void Control.** Compact dense-graded hot-mix asphalt to contain from 5% to 9% in-place air voids. Do not increase the asphalt content of the mixture to reduce pavement air voids.
- a. Air Void Determination.** Unless otherwise shown on the plans, obtain 2 roadway specimens at each location selected by the Engineer for in-place air void determination. The Contractor's laboratory will measure air voids in accordance with Tex-207-F and Tex-227-F. Before drying to a constant weight, cores may be predried using a Corelok or similar vacuum device to remove excess moisture. Use the

average air void content of the 2 cores to calculate the in-place air voids at the selected location.

b. Air Voids Out of Range. If the in-place air void content in the compacted mixture is below 5% or greater than 9%, then change the production and placement operations to bring the in-place air void content within requirements. Suspend production until the in-place air void content is brought to the required level, and a test the completed section.

c. Test Section. Construct a test section of 1 lane-width and at most 500 feet in length to demonstrate that compaction to between 5% and 9% in-place air voids can be obtained. Continue this procedure until a test section with 5% to 9% in-place air voids can be produced. When a test section producing satisfactory in-place air void content is placed, begin and or resume full production.

2. Ordinary Compaction Control. If approved by the City of Canyon, ordinary compaction may be used. If used, furnish the type, size, and number of rollers required for compaction, as approved. At a minimum, furnish at least 1 approved vibratory roller and 1 medium pneumatic-tire roller (minimum 12-ton weight). Use the control strip method given in the Texas Department of Transportation Standard, Tex-207-F, Part IV, to establish rolling patterns that achieve maximum compaction.

Follow the selected rolling pattern unless changes that affect compaction occur in the mixture or placement conditions. When such changes occur, establish a new rolling pattern. Compact the pavement to meet the requirements of the plans and specifications.

3. Temperature. 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 Asphalt Concrete" will be measured by a unit of surface area (square yard or as stated in the proposal) or weight (ton or as stated in the proposal) of the hot-mix asphalt 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 Asphalt 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 asphalt concrete pavement, rolling and finishing; and for all manipulations, labor, tools, equipment, testing, and incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION

SUBSECTION 4.14 CONSTRUCTION AND PERMANENT PAVEMENT MARKINGS

I. SCOPE

This item includes the placement, maintenance, and prompt removal of pavement markings when required during construction operations and subsequent permanent pavement markings installed at the completion of construction.

Construction pavement markings shall consist of guidemarks, short term markings and / or standard pavement markings. All roadways to be opened to traffic shall be marked with short term markings or standard markings, to recreate the placement and layout of the permanent markings prior to the construction or as shown on the plans if the layout is different from the pre-construction layout. This includes word and symbol markings where applicable. Temporary markings shall be placed at the end of each day's construction operations as needed. All markings shall comply with standards set forth in the Texas Manual of Uniform Traffic Control Devices (TMUTCD), latest edition.

II. MATERIALS

A. Temporary markings during construction: Unless otherwise shown on the plans or specified, materials used for construction pavement markings shall be raised pavement markers, prefabricated pavement marking material (temporary striping), temporary flexible-reflective marker tabs or other materials approved by the City or its Engineer. Temporary flexible-reflective marker tabs shall be the preferred choice of material to be used for short term construction pavement markings. 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.

B. Permanent markings: Unless otherwise shown on the plans or specified, materials used for permanent pavement markings shall be reflectorized, paint-type materials that are applied at ambient or slightly elevated temperatures. Materials shall be waterborne, Type II, and conform to Federal Specification TT-P-1952D or TxDOT material specifications DMS-8200, YPT-10 (yellow) and / or WPT-10 (white) and DMS-8290 (glass beads).

III. EQUIPMENT

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

IV. CONSTRUCTION METHODS

A. Surface Preparation: Surfaces to be marked shall be clean, free of oil, water, moisture, laitance or any other foreign or deleterious substances. Asphaltic pavement surfaces shall be cleaned by brushing, washing, compressed air, sweeping, high pressure water or any combination thereof to remove all forms of contamination and loose material. If existing markings are encountered, they shall be cleaned sufficiently to remove loose and flaking materials. The existing markings shall be completely removed when applicable. The new pavement surface (asphalt or concrete) shall be allowed to cure sufficiently prior to installing permanent markings. Cure time to be as recommended by the coating manufacturer. Traffic may be permitted on new pavement surfaces while curing before permanent markings are installed. The Contractor shall maintain the construction markings to the satisfaction of the City, its Engineer or designated representative.

B. 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.

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. Temporary markings shall be placed in proper alignment with the final location of the permanent standard markings. Any markings not in alignment with the final location shall be removed and replaced to the correct alignment at the Contractors expense.

Permanent markings shall be applied in accordance with the manufacturer's latest published requirements, specifications and details. Markings shall be applied with pressurized, self-contained paint machines capable of applying straight lines from 4" to 8" in width and with a minimum coverage rate of 100 sq. ft. per gallon. Pavement and ambient air temperature must exceed 50° F for marking application. Paint shall be applied when the relative humidity is less than 85% and / or the air temperature is greater than 5°F above the dewpoint temperature. Markings shall be applied at a rate of approximately 15 mils wet film thickness, 7-10 mil dry film thickness. Glass beads shall be applied to the materials at a uniform rate sufficient to achieve uniform retroreflective characteristics. Markings shall be applied in winds light enough to insure clean, crisp edges, free of overspray and adequate, uniform glass bead dropping. Markings shall be dried enough to prevent pick-up within 10-20 minutes of application. Lettering and symbols shall be applied using approved stencils or templates.

Pavement markings for new surface treatments (sealcoats, slurry seals or micro-surface treatments) shall be applied in two (2) applications, each one being applied at approximately one-half of the total application rate. The first application shall not contain glass beads. The interval between applications shall be a minimum of one (1) hour.

C. 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 City or its designated representative. Removal of the markings shall leave no discernible evidence of the marking ever having been placed. Removal of markings shall be conducted by flailing, waterblasting or sandblasting according to TxDOT Standard Specification Item 677, "Eliminating Existing Pavement markings and Markers".

D. Traffic Control: The Contractor shall furnish all equipment (temporary signage, barricades, cones, etc.) and personnel (flaggers) for the purpose of expediting safe and efficient passage of traffic through the work zone. All construction detours, signing, and barricading must be in accordance with the Texas Manual of Uniform Traffic Control Devices and approved by the Street Superintendent or Director of Public Works prior to construction. No separate payment for furnishing traffic control labor and material shall be made unless indicated in the bid proposal.

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. Measurement for pavement markings may be by the linear foot, square foot or lump sum, depending on the project.

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 and Permanent 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.

LAST PAGE OF THIS SUBSECTION