

Street Specifications Section 200

210 Pavement Design Criteria

211 General Information

211.01 Design Criteria: All streets shall be constructed on a compacted or stabilized subgrade, shall consist of a base and surface course, and shall take into account subsurface drainage where appropriate (hills and natural springs), and shall meet the minimum requirements as set forth in the tables at the end of this section. In the event a Geotechnical Analysis shows that pavement designs are less than what is required in the subsequent tables, the minimums shall be used as documented in the tables..

A Geotechnical Analysis shall be prepared at the expense of the design consultant or developer by a qualified and independent geotechnical engineer licensed to practice in the State of Texas. The field investigation shall include test borings within the rights-of-way spaced not less than 500 feet for all proposed streets. A minimum of two (2) test borings are required. Atterberg limits and moisture contents shall be determined for all significant boring samples. The method used for these determinations shall be the same as those used by the State Department of Highways and Public Transportation (SDHPT) using their latest Manual of Testing Procedures, 100-E Series test methods. The results of the investigation shall be presented to the City in written report form. Included as part of the report shall be graphical or tabular presentation of the boring data giving Atterberg limits and moisture contents, a soil description of the layers of different soils encountered in the profiles of the hole, their limits in relation to the fixed surface datum, and such other information as needed to complete the soils investigation for pavement design purposes. Minimum soils profile boring holes shall be ten (10) feet unless solid rock formations are encountered sooner.

A written report containing pavement design data and recommendations based on the soils investigation shall be prepared by a qualified geotechnical engineer licensed to practice in the State of Texas and shall be presented to the City. The report shall state the load criteria and the soil classifications used. When approved by the City, the geotechnical engineer preparing the report may use the triaxial classification soils data given in the SDHPT report number 3-05-71-035 entitled "Triaxial Classification of the Surface Soils of Texas as Grouped by Soil Conservation Services Series".

When using the triaxial data, the report shall so state. The pavement design shall be subject to the approval of the City and shall be shown on the street construction plans as approved. Where the Plasticity Index (PI) of the subgrade soil (on which the street is to be built) is in excess of twenty (20), the pavement design shall include subgrade stabilization unless approved otherwise by the City. When subgrade soils are stabilized, the minimum depth of stabilization shall be eight (8) inches unless otherwise approved by the City. In swelling clay soils stabilization, the stabilizer used shall be the addition of lime. The lime shall be applied to the subgrade soil in the slurry form unless otherwise approved by the City.

STREET DESIGN CRITERIA						
FEATURE	ALLEY*	ACCESS	RESIDENTIAL 3 – 80 D.U.		RESIDENTIAL 81 – 200 D.U.	
			URBAN	LARGE LOT**	URBAN	LARGE LOT**
# Of Lanes	1	2	2	2	2	2
Width of Pavement	15'	31' (B – B)	27' (B – B)	26' (B – B)	31' (B – B)	30' (B – B)
R.O.W. Width	20'	50'	50'	50'	60'	60'
Design Speed (MPH)	20	30	25	25	25	25
City of Burnet Standard Specifications			Section 200 -1		Street Specifications	

Median Width	--	--	--	--	--	--
Parkway Width	--	9.5'	9.5'	9.5'	9.5'	9.5'
Median Opening Spacing	--	--	--	--	--	--
Cul de Sac Diameter	--	--	96'	96'	96'	96'
Cul de Sac Typical Radius	--	--	48'	48'	48'	48'
Cul de Sac Max Length	--	--	≤ 600'	≤ 600'	≤ 600'	≤ 600'
Street Intersection Radius (Curb)	25'	25'	25'	25'	25'	25'
Corner Clip R.O.W. Dedication	7.5' X 7.5'	7.5' X 7.5'	7.5' X 7.5'	7.5' X 7.5'	7.5' X 7.5'	7.5' X 7.5'
Max Degree of Curvature or Minimum Radius For Design (Center Line) (Normal Crown)	--	13°/300'	19°/300'	19°/300'	19°/300'	19°/300'

STREET DESIGN CRITERIA (Cont')						
FEATURE	COLLECTOR		PRINCIPAL ARTERIAL		ANY COMMERCIAL OR INDUSTRIAL SUBDIVISION	
	URBAN OR LARGE LOT SUBDIVISIONS					
# of Lanes	2	4	4	6	2	4
Width of Pavement	37' (B – B)	49' (B – B)	25' (B – B)	37' (B – B)	37' (B – B)	49' (B – B)
R.O.W. Width	60'	80'	100'	100'	60'	80'
Design Speed (MPH)	30	40	50	50	30	30
Median Width	--	--	25'	23'	--	--
Parkway Width	11.5'	15.5'	12.5'	11.5'	--	--
Median Opening Spacing	--	--	400' – 600'	400' – 600'	--	--
Cul de Sac Diameter	--	--	--	--	100'	100'
Cul de Sac Typical Radius	--	--	--	--	48'	48'
Cul de Sac Max Length	--	--	--	--	≤ 600'	≤ 600'
Street Intersection Radius (Curb)	25'	30'	35'	35'	25'	30'
Corner Clip R.O.W. Dedication	7.5' X 7.5'	9.5' X 9.5'	10.5' X 10.5'	10.5' X 10.5'	7.5' X 7.5'	9.5' X 9.5'
Max Degree of Curvature or Minimum Radius for Design (Center Line) (Normal Crown)	13°/300'	7°/300'	4°/300'	4°/300'	13°/300'	7°/300'

NOTES:

- 1) The above design standards are considered to be minimum standards. Other design elements such as stopping sight distance, super-elevation, grades, etc. shall be used in design whenever appropriate as dictated by good engineering practice.
- 2) Additional right-of-way will be required at major intersections for left or right turn lanes (if required) to maintain traffic volume capacities through the intersection.
- 3) Additional right-of-way will be required for acceleration or deceleration lanes where appropriate.
- 4) Under special conditions, the City Engineer will determine the maximum Degree of Curvature.
- 5) Additional right-of-way may be required for bikeways. If the road right-of-way is determined to be unsuitable for bikeways, a bikeway easement may be located on another alignment deemed more appropriate.
- 6) Ribbon curbs on both sides of the roadways are included in the widths reflected in Table 200-1. Standup curb will be in addition to those widths shown.
- 7) *Plans reflecting alleys are not permitted without first obtaining the approval of the Planning and Zoning Commission and the City Council.
- 8) **No on-street parking shall be permitted on these streets.

ITEM

*Subgrade Depth of
Street Specifications

MINIMUM THICKNESS CRITERIA FOR HMAC ROADS					
ITEM	ROADWAY CLASSIFICATION				
	ALLEY	ACCESS	RESIDENTIAL	***COLLECTOR	PRINCIPAL ARTERIAL
*Subgrade Depth of Compaction	8"	8"	8"	8"	8"
** Base Course Thickness	8"	8"	8"	10"	10"
Surface Course Depth (Type "C" or Type "D") HMAC	2"	2"	2"	2.5"	3"

NOTES:

*Subgrade shall be compacted to 95 – 100% of optimum density per TxDOT TEX-114E Test Method to a depth of 8".

**Flexbase compacted to 98% - per TxDOT TEX 113-E Test Method

Subgrades with "Moisture Sensitive" material shall be treated with one of four options outlined in Section 212.

***Pavement constructed in industrial parks or areas zoned Industrial shall be built to the same standards as a Collector Road.

MINIMUM THICKNESS CRITERIA FOR PORTLAND CEMENT ROADS					
ITEM	ROADWAY CLASSIFICATION				
	ALLEY	ACCESS	RESIDENTIAL	***COLLECTOR	PRINCIPAL ARTERIAL

*Subgrade Depth of Compaction	8"	8"	8"	8"	8"
** Base Course Depth Flexible Base	6"	6"	8"	8"	10"
Surface Course Depth of Concrete	5"	5"	6"	8"	10"

NOTES: *Subgrade shall be compacted to 95 – 100% of TxDOT – 114E to a depth of 8”.

**Flexible base compacted to a minimum of 98% of per TxDOT TEX 113-E Test Method

***Pavement constructed in industrial parks or areas zoned Industrial shall be built to the same standards as a Collector Road.

211.02 Sidewalks: Sidewalks along Arterial/Parkway/Collector Streets shall be shown on the construction plans as a public improvement and constructed when the street is built. Construction of sidewalks along Minor Residential/Marginal Access/Access streets can be delayed until the lot is developed if so desired. The sidewalks shall be designed and built a minimum of 5’ off the back of curb up to 8’ maximum off the back of curb if possible unless otherwise determined by the City.

Sidewalk Widths shall :

Arterial/Parkway Streets 5 feet min
Collector Streets 5 feet min
Minor Residential Streets 4 feet min
Marginal Access Streets 4 feet min
Access Streets 4 feet min

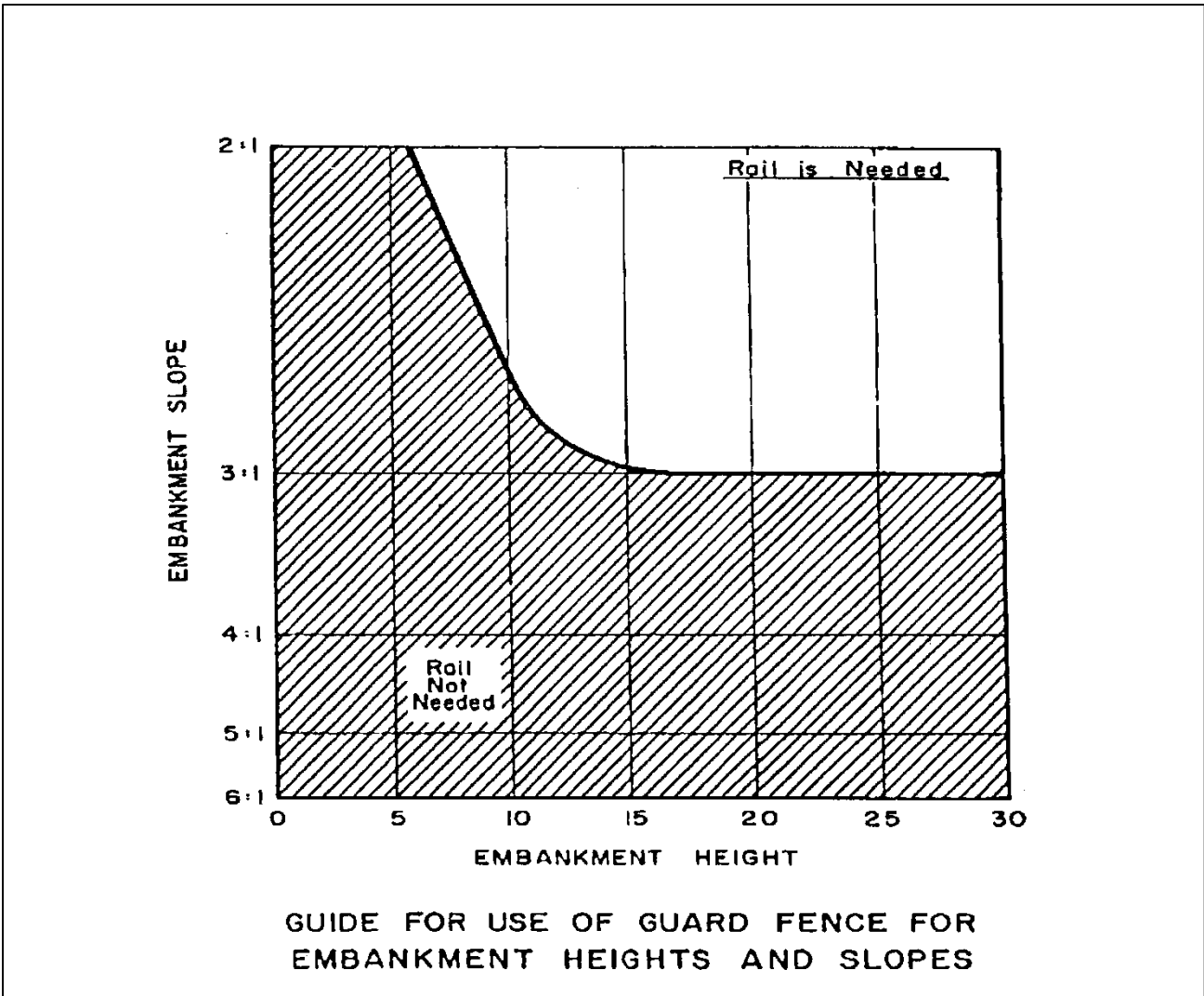
Sidewalks shall be constructed, or a financial surety in the amount of the construction cost, shall be posted with the City prior to any structure/use receiving a Certificate of Occupancy.



211.03 American Disability Act: All new construction and reconstruction of streets shall conform to the Texas Department of Licensing & Regulations (TDLR) standards. If the overall project cost exceeds the limit specified by TDLR then the construction plans must be submitted for approval to TDLR or a licensed TAS reviewer. A copy of all documentation provided for TAS review, as well as the state or RAS review response, shall be provided to the City of Burnet.

211.04 Retaining Walls – When the design engineer cannot maintain stable embankments at the edge of the right of way due to steep drop-offs or inclines then a retaining wall may be warranted. Retaining walls taller than 4 feet in height must be designed by a professional engineer.

211.05 Metal Beam Guard Fence – The combination of embankment height and side slope rate may warrant barrier protection as shown in the figure below. For low fill heights a more abrupt slope rate is tolerable than at high fill heights. Since 4:1 and steeper side slopes provide little opportunity for drivers to redirect vehicles at high speeds, in the absence of guard fence an area free of obstructions should be provided by the designer beyond the toe of slope.



212 Subgrades With Moisture Sensitive Material:

Moisture Sensitive material is defined as material with PI of 20 or greater (as determined by ASTM D-4318) and 35% or more passing the #200 sieve (as determined by ASTM D-1140). Subgrades with Moisture Sensitive material shall be treated with the following options:

1. Replace 18" of subgrade with approved native material with PI less than 15 and more than 4 **or**
2. Lime Stabilize 8" of subgrade according to City of Burnet Standard Specifications **or**
3. Increase the thickness of the design flexible base (concrete pavement only) to 10.5" **or**
4. Use Portland Cement to stabilize the subgrade according to City of Burnet Standard Specifications.

Developer or contractor shall provide necessary geotechnical information to verify moisture conditions within the subgrade.

213 Alignment

213.01 Allowable Grades and Where Concrete Must be Used:

- A. The maximum grade by Subdivision Ordinance is outlined below. The design of steep grades is based on the types of vehicles that will negotiate the street.
 1. Residential: maximum grade is 15%
 2. Collectors: maximum grade is 10%
 3. Arterials: maximum grade is 10%
- B. Minimum grades are governed by drainage conditions. With curbed pavements, longitudinal grade criteria should be provided to facilitate surface drainage. When grades are 0.49% or under, concrete streets must be placed. The minimum allowable grade (concrete pavement only) is 0.35%.
- C. Portland Cement Concrete pavement shall be used on all classes of streets when the combination of the grade of the street exceeds 10% and is within 60 feet of an intersection.

213.02 Vertical Curves: Vertical curves should be simple in application and should result in a design that is safe, comfortable in operation, pleasing in appearance, adequate for drainage, and provide for minimum stopping site distance.

The design criteria for vertical curves shall be the American Association of State Highway and Transportation Officials (AASHTO) in the latest edition of *A Policy on Geometric Design of Highways and Streets*.

213.03 Horizontal Curves: There are four types of horizontal curves: simple, compound, reversed, and spiral. The recommended design criteria for horizontal curves shall be based on information provided by the American Association of State Highway and Transportation Officials in the latest edition of *A Policy on Geometric Design of Highways and Streets*.

213.04 Sight Distance: Intersections should be planned to allow an adequate amount of sight distance for the automobile to be able to come to a smooth stop. Stopping sight distance on all approaches should be determined. The stopping sight distance (SSD) is given as:

$$SSD (ft) = 1.47ut + u^2/30(f \pm g)$$

where S = is stopping sight distance in feet
u = Design velocity in mph

t = Perception reaction time, (2.5 seconds)
 f = Coefficient of friction, Reference (*A Policy for Geometric Design of Highways and Streets*, AASHTO, 1984.
 g = percent of grade divided by 100 (+ for upgrade, - for downgrade)

213.05 Visibility Triangles: The intersections of all streets and alleys with streets or other alleys shall have adequate visibility triangles dedicated as Right of Way to the City as noted below.

Alley intersects Residential Street	10' x 10'
Residential intersects Residential	10' x 50'
Residential intersects Collector	10' x 100'
Residential intersects Arterial	10' x (10' multiplied by speed of Arterial)

Example: For a residential street intersecting an arterial with a speed limit of 45 mph, the visibility triangle dedicated as Right of Way would be 10' x 450' (10' multiplied by 45).

213.06 Intersection Curb Radii: The following radius distances shall be used in the design and construction of all streets and alleys:

Alley with Alley	15'
Alley with Residential	15'
Residential with Residential	20'
Residential with Collector	30'
Collector with Collector	30'
Collector with Arterial	30'
Arterial with Arterial	50'

220 Roadway Excavation and Subgrade Preparation

221 General

221.01 Description: This section shall consist of the required clearing and grubbing of all areas to be excavated or receive embankment; all required excavation within the limits of the project (except as otherwise classified); cleaning out and shaping ditches as indicated; the removal and proper utilization or disposal of all excavated materials; the construction, compaction, shaping and finishing all earthwork within the limits of the project, all in conformity with required lines, grades and typical cross-section and in accordance with these specifications.

221.02 Testing and Soil Sample Locations: The existing natural grade shall be excavated to the correct line and grade and then tested to determine the soil classification, Plasticity Index (PI) per ASTM D-4318, percent passing #200 sieve (ASTM D-1140), optimum moisture content and optimum density per TxDOT TEX – 114E Test Method for areas of fill less than ten feet or TxDOT TEX – 114E Test Method for areas of fill ten feet or more. Soil samples shall be taken from each location where there is an obvious change in soil classification and at the direction of the city engineer or his designated representative (city construction inspector).

222 Construction Work

222.01 Clearing and Grubbing: Clearing and grubbing shall consist of removal of all organics, soft soils, trees, brush, logs, down timber, fence posts, wire and other debris of all kinds from the sites of the street and utility work. All stumps and other objectionable matter, all roots and other projections shall be removed to a depth of one foot below the subgrade elevation if located in cut area, and one foot below the natural ground surface in other areas. Disposal of all refuse obtained from clearing operations shall be in a manner approved by the City Public Works Inspector or the City Engineer, and shall conform to state laws and local ordinances.

222.02 Excavation: Excavation shall be performed at the locations required to bring the subgrade of

the areas to be paved to established alignment, grade and cross section. All suitable excavated materials shall be utilized insofar as practicable in constructing the required sections and shall be spread as directed in such manner as to present a neatly finished appearance, and not obstruct the drainage or cause injury to any street improvements or to abutting property. Unsuitable excavation and excavation in excess of that needed for construction shall be known as Waste and shall become the property of the Contractor to be disposed of by him outside the limits of the right of way at a location approved by the Public Works Inspector or the Engineer.

222.03 Embankment: Prior to placing any embankment, all clearing and grubbing operations shall have been completed on the areas over which the embankment is to be placed. Stump holes or other small excavations or depressions within the limits of the embankment shall be backfilled with suitable material to the original slope by blading or other methods, indicated on plans or required by the Engineer. Suitable material will not be 'Moisture Sensitive' as defined in Section 212. The ground surface thus prepared shall be compacted by sprinkling and rolling as described below in 222.04 Compaction.

A. All fill material shall be placed in uniform layers of not more than eight (8) inches in depth (loose material) for compaction by sheepsfoot rolling or six (6) inches pneumatic tire, flat wheel, or vibratory steel wheel rolling for the full width of the cross section. Each loose layer shall be compacted as described below in 222.04 Compaction. The method of compaction shall be such that a uniform density will be obtained over the entire area and the depth of materials being compacted. All fill material deposited in place by means of dump trucks, draglines, or other similar equipment shall be thoroughly broken up so as to be free from lumps, large stones and clods before being spread into uniform layers. Each layer shall be graded so as to conform to finish grade of street section.

B. Embankment placed adjacent to, over and under pipes shall be suitable material and shall be placed in successive layers approximately horizontal or parallel with the finished grade. For areas of embankment adjacent to curbs, walks, etc. where it is impractical to employ the compaction methods above specified, the embankment shall be placed in layers not exceeding two (2) inches in depth of loose material, thoroughly mixed and wetted (or dried) uniformly to the approved methods, such as mechanical hand tampers, maintaining the required moisture content by additional sprinkling if necessary, until each layer has been uniformly compacted to the satisfaction of the Public Works Inspector or the City Engineer.

222.04 Compaction & Moisture Content : All materials to receive compaction in fill areas less than 10 feet vertically shall be thoroughly mixed and wetted (or dried) as may be required to produce the optimum moisture of that material as determined by the moisture-density relationship in accordance with the TxDOT TEX – 114E Test Method (materials receiving compaction in fill areas 10 feet or more vertically shall use the TxDOT TEX – 114E Test Method). For 'Moisture Sensitive' material the moisture content shall be within 3% (+ or -) of the optimum otherwise it shall require rework. It shall then be rolled with an approved sheepsfoot producing a minimum compression of 150 pounds per square inch of cross sectional area on each tamping foot until a uniform compaction of at least 95% of optimum density per TxDOT TEX – 114E Test Method is obtained (Modified Proctor for 10 feet or more of fill). Proof rolling may be substituted for density testing when approved by the Public Works Inspector and the City Engineer.

222.05 Proof Rolling: This item shall govern furnishing and operating heavy pneumatic tired compaction equipment for locating unstable areas of embankment, subgrade and flexible base courses.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

Submittals

The submittal requirements of this specification item may include:

- A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), type of roller, size, weight, tire pressure (if appropriate) and configuration of each individual roller, and
- B. The operating speed proposed for each individual roller.

Equipment

- A. Standard Proof Roller:

The proof rolling equipment shall have a loading platform or body suitable for ballast loading that is supported on a minimum of two (2) axles with not more than two (2) pneumatic tired wheels per axle. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces. Pneumatic proof rolling equipment with multiple pivotal axles and more than two tires along the front or rear axle axis shall have articulating axle supports to equally distribute the load to all tires over uneven surfaces.

The proof roller unit, under working conditions, shall have a minimum contact width of 7-1/2 feet (2.3 meters) and shall be so designed that the gross roller weight may be varied uniformly from 25 tons to 50 tons (23 megagrams to 45 megagrams) by ballast loading. The tires shall be capable of operating under various loads with variable air pressures up to 145 psi (up to 1000 kiloPascals). The tires shall be smooth tread and shall impart a minimum ground contact pressure of 75 pounds per square inch (520 kiloPascals). Tires shall be practically full of liquid (i.e. when liquid will flow from the valve stem of a fully inflated tire with the stem in the uppermost position). The operating load and tire pressure shall be within the range of the manufacture's chart as directed by the Engineer or designated representative.

The proof roller shall be drawn by a power train of adequate tractive effort or may be of a self-propelled type. The proof rolling equipment shall be equipped with a reverse mode transmission or be capable of turning 180 degrees in the street width. When a separate power train is used to draw the proof roller, the power train weight shall not be considered in the weight of the proof roller. The power train shall be rubber-tired when rolling subgrade and base materials. A cleated or track-type power train may be used on earth and rock embankments.

- B. Alternate Equipment:

With the written approval of the City Engineer or designated representative, the Contractor may utilize alternate equipment on embankment courses, subgrade and base courses subject to the requirements of the standard proof roller except with respect to minimum contact width, axle/tire arrangement and tire tread.

Alternate equipment for stability testing of embankments shall be restricted to equipment that can be shown to impart a stress distribution on the embankment structure equivalent to or greater than the stress induced by the concentrated weight of a standard proof roller.

- C. Equipment Submittals:

All standard proof rollers and proposed alternate equipment must be approved by the Engineer or designated representative prior to their use. The Contractor shall furnish the Engineer or designated representative with charts or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished.

Alternate equipment submittals for proof rolling of embankments shall be signed and sealed by a registered Professional Engineer licensed in the State of Texas.

Construction Methods

A. General:

Within the ranges set forth in Equipment (A) above, the load and tire inflation pressures shall be adjusted as directed by the Engineer or designated representative. It is proposed to use a contact pressure corresponding as nearly as practical to the maximum supporting value of the earthwork or base. The entirety of prepared surfaces to be tested by this method shall be proof rolled by a minimum of two passes or the proof roller tires. Each succeeding trip of the proof roller shall be offset by not greater than one tire width.

When alternate equipment is proposed and only one axle meets minimum requirements, only the qualifying axle shall be used to proof roll. If the operation of the proof roller shows an area to be unstable, the substandard area shall be brought to satisfactory stability and uniformity by additional curing, compaction, or by removal and replacement of unsuitable materials. The re-worked area shall then be proof rolled.

Proof rollers shall be operated at speeds between 2 and 6 miles per hour (3 and 10 kilometers per hour) or as directed by the Engineer or designated representative.

Acceptable limits of elastic and plastic deformation of prepared subgrade courses shall be established by proof rolling Test Sections of representative soil conditions, previously tested and approved for density and moisture requirements of the governing subgrade and earth embankment items. Proof rolling of first course base over a plastic subgrade may be waived by the Engineer or designated representative if it is determined that the prepared first course base will be damaged by the proof roller.

B. Roadway Construction:

The subgrade and all lifts of base material shall be proof rolled in new roadway construction and in the reconstruction of existing streets. Proof rolling of the curb course base shall be substituted for proof rolling of final course base at the direction of the Engineer or designated representative. Proof rolling may be waived by the Engineer or designated representative where construction is limited to turn lanes, street widening less than 7-1/2 feet (2.3 meters) in width, or where the site is otherwise congested.

C. Trenches:

Trenches shall be proof rolled where no limitations to the operation of the proof roller exist as may be determined by the Engineer subject to the provisions hereunder.

All trenches shall be proof rolled in new roadways or in existing roadways under reconstruction. Trenches shall be proof rolled at the street subgrade elevation by longitudinal and perpendicular passes of the roller as may be dictated by the width of the trench.

Proof rolling of trenches in existing paved streets shall be limited to pavement cross-sections capable of sustaining the weight of the proof rolling equipment without imparting damage to the remaining pavement structure as determined by the Engineer. Trenches less than 4 feet (1.2 meters) in width shall be exempted of all proof rolling requirements. Only the final course base shall be proof rolled in trenches 4 feet (1.2 meters) or wider but narrower than the proof roller contact width. The subgrade, the first course and the final course base shall be proof rolled in trenches 7-1/2 feet (2.3 meters) or wider.

D. Embankment Construction:

All embankment courses shall be proof rolled, unless otherwise directed by the Engineer or designated

representative.

If required by the Engineer or designated representative, stability testing of embankments constructed to the finished cross-section and elevation or to interim elevations shall either be conducted with a standard proof roller or alternate equipment, which can be proven to impart a horizontal and vertical pressure distributions equivalent to or greater than those induced by a standard proof roller.

223 Testing

223.01 Minimum Requirements: The Contractor shall provide independent soils laboratory testing to determine the plasticity index (ASTM D-4318), the percent of material passing #200 sieve (ASTM D-1140), and density curve for the subgrade material (TxDOT TEX 114-E), field density testing of the completed subgrade shall be 95%-100% for fill less than 10 feet and 95%-100% modified proctor for fill 10 feet or greater. The subgrade shall be tested at minimum intervals of one per 8" lift per 100 lineal feet of proposed pavement or as shown on the construction plans. All testing must be done in the presence of a city construction inspector; the inspector has the authority to pick locations for all tests. A field density test shall be conducted at each point the subgrade crosses an excavated area. Proof rolling may be substituted for density testing when approved by Engineer. A copy of all tests shall be submitted to the City Engineer.

230 Stabilized Subgrade

231 Lime Stabilized Subgrade

231.01 General: This section shall consist of the requirements for hydrated lime, quicklime and commercial lime slurry; the treating of subgrade; pulverizing, adding lime, mixing, and compacting the treated material in accordance with these specifications.

Lime shall be applied as provided for in the specifications, as a dry material or as a mixture of lime solids and water in the form of lime slurry.

For dry application, Type A, Hydrated Lime or Type C, Quicklime or Grade DS may be used where specifications permit.

For wet application, lime slurry may be delivered to the jobsite as Type B, Commercial Lime Slurry or a lime slurry may be prepared at the job site or other location approved by the Engineer, by using Type A, Hydrated Lime or Type C, Quicklime as specified.

231.02 Types: The various types and grades are defined and identified as follows:

1. Type A, Hydrated Lime, a dry powdered material consisting essentially of calcium hydroxide.
2. Type B, Commercial Lime Slurry, a liquid mixture of essentially hydrated lime solids and water in slurry form.
3. Type C, Quicklime, a dry material consisting essentially of calcium oxide. It shall be furnished in either of two grades that differ in sizing.
4. Grade DS, "pebble" quicklime of a gradation suitable for either dry placement or for use in a slurry.
5. Grade S, finely-graded quicklime for use in a slurry. The use of this type is unsuitable for dry placement.

231.03 Preparation: Prior to treating existing material, it shall be shaped to conform to the typical sections, as shown on the plans. When the Contractor elects to use a cutting and pulverizing machine that will process the material to the plan depth, the Contractor will not be required to excavate to the secondary grade or windrow the material. In lieu of using the cutting and pulverizing machine, the Contractor shall excavate and windrow the material to expose the secondary grade to the typical

sections as shown on the plans.

231.04 Placing: The percentage by weight or pounds per square yards of lime to be added will be as shown on the plans. Lime shall be spread only on that area where the mixing operations can be completed during the same working day. The lime operation shall not be started when the air temperature is below 40 F and falling, but may be started when the air temperature is above 35 F and rising. Lime shall not be placed when weather conditions in the opinion of the Engineer are unsuitable.

During the interval between application and mixing, hydrated lime that has been exposed to the open air for a period of six hours or more or to excessive loss due to washing or blowing will not be accepted.

231.05 Mixing: The material and lime shall be thoroughly mixed and brought to the proper moisture content. It may be left to cure, or "rot" one to four days. In addition to the above, when Type C Quicklime, Grade DS is used, the material and lime shall be mixed as thoroughly as possible at the time of the lime application. Sufficient moisture shall be added during the mixing to hydrate the quicklime. After mixing, and prior to compaction, the mixture shall be moist cured for two to seven days. After curing, mixing shall continue until the pulverization requirements are met.

231.06 Pulverization: Following mixing, a sample of the material at roadway moisture shall be obtained for pulverization testing. All nonslaking aggregates retained on the 3/4-inch sieve will be removed from the sample. The remainder of the material shall meet the following pulverization requirement:

	Percent
Minimum passing 1-3/4" sieve-----	100
Minimum passing 3/4" sieve-----	85

231.07 Compaction: Compaction of the mixture shall begin immediately after the pulverization requirement is met. 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 as shown on the plans. The completed section shall then be finished by rolling with a pneumatic tire or other suitable roller. The completed section shall be moist cured or prevented from drying by addition of an asphalt material at the rate of 0.05 to .20 gallons per square yard.

When a section is reworked more than 72 hours after completion of compaction, the Contractor shall add 25 percent of the specified rate of lime. Reworking shall include loosening, mixing, compacting, and finishing. When a section is reworked, a new optimum density will be required.

231.08 Testing Requirements: The contractor shall provide independent soils laboratory testing to determine the density curve of the lime treated subgrade, and field testing of the completed subgrade to determine the density and thickness. The completed section shall be compacted to the extent necessary to provide not less than 98 percent of optimum density in accordance with TxDOT TEX 113-E test method. Density and Thickness testing will be required at the rate of one test per 1200 lineal feet per travelway, or fraction thereof.

When the material fails to meet the required density, or should the material lose the required stability, density or finish before the next course is placed, it shall be reworked.

232 Cement Stabilized Subgrade

232.01 General: This item shall consist of the requirements for Portland cement; the treating of subgrade by the addition of Portland cement; road mixing and compacting the treated material in accordance with these specifications.

New flexible base shall conform to the material requirements of Section 240, "Flexible Base" and shall be of the type and grade as shown on the plans. Type I and Type II Portland cement shall conform to the requirements of ASTM C150. Different brands or different types of cement, or the same brand or type from different mills shall not be mixed in storage. Bags of cement shall contain 94 pounds net and a barrel shall be considered as containing 376 pounds net.

232.02 Preparation: The completed course shall be uniformly treated, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and shall have a smooth surface.

Prior to scarifying or pulverizing existing material, the subgrade shall be shaped to conform to the typical sections as shown on the plans. The Contractor shall proof roll the roadbed before pulverizing or scarifying existing material. Soft spots shall be corrected.

When the Contractor elects to use a cutting and pulverizing machine that will process the material to the plan depth, the Contractor will not be required to excavate to the secondary grade and windrow the material. In lieu of using the cutting and pulverizing machine, the Contractor shall excavate and windrow the material to expose the secondary grade. The windrowed material shall be uniformly replaced before cement is applied.

232.03 Placing: The percent of cement to be added will be as shown on plans. Cement shall be spread only in that area where the mixing, compacting, and finishing operations can be completed the same working day. The cement treatment operation shall not be started when the air temperature is below 40°F and falling, but may be placed when the air temperature is above 35°F and rising. Cement shall not be placed when the weather conditions in the opinion of the City Engineer or the City Public Works Inspector are unsuitable.

232.04 Mixing: The cement shall be dry mixed with the material prior to the addition of water. Immediately after dry mixing, water shall be uniformly applied. After mixing, the mixture shall be in a loose, evenly spread state ready for compaction. The mixture shall be mixed and compacted in one lift. The percentage of moisture in the mixture shall be within +/- two percentage points of optimum as determined by Test Method Tex-120-E, Part II.

232.05 Compaction: Compaction shall be completed within two hours of the addition of water to the dry mixed material. Immediately after compaction, the surface shall be clipped, skinned, or tight bladed by a maintainer or subgrade trimmer to a depth of approximately 1/4", removing all loosened material. The surface shall then be rolled with a pneumatic tire roller, adding small increments of moisture as needed during rolling.

232.06 Curing: The completed section shall be moist cured for three days or prevented from drying by addition of an asphalt material at the rate of 0.05 to 0.20 gallon per square yard.

232.07 Minimum Requirements: The Contractor shall provide independent soils laboratory testing to determine the density curve of the cement treated subgrade, and field testing of the completed subgrade to determine the density and thickness. The course shall be sprinkled and compacted to the extent necessary to provide not less than 98 percent of optimum density in accordance with TxDOT TEX-113E Test Method. Density and Thickness testing will be required at the rate of one test per 100 lineal feet per travelway, or fraction thereof.

When the material fails to meet the density requirements or should the material lose the required stability, density, or finish before the next course is placed, the treated material shall be removed and replaced. Removal and replacement with acceptable treated material will be at the Contractor's expense.

240 Flexible Base

241 General

241.01 Description: This section shall consist of a foundation course for Pavement surface courses and concrete curb & gutter and shall be constructed as herein specified in one or more courses in conformity with the typical sections and to the lines and grades as established by the Engineer.

241.02 Requirements: A base course of crushed rock flexible base, consisting of durable particles of stone mixed with approved binder material shall be installed on the finished subgrade. The material for this course shall be from a source approved by the City Engineer and City Public Works Inspector and shall be placed and compacted in two or more courses to obtain a minimum of 98% of the TxDOT TEX 113-E Test Method.

242 Material

242.01 General Requirements: The materials shall consist of TxDOT approved Type A, Grade 1, 1 3/4" crushed dolomitic limestone or material equal to the TxDOT criteria, mixed with an approved binding material compacted to not less than one hundred (98%) per cent of the optimum density in accordance with TxDOT TEX-113E Test Method. Crushed gravel or uncrushed gravel will not be acceptable. Absolutely no kuliches materials are permitted. The Contractor shall provide at his own expense, test results for the material determined by an acceptable independent soils testing laboratory. A test report containing soil constants, gradation and wet ball mill of the base material shall be made available prior to the compaction operations.

After compaction and adequate curing of base material, density tests shall be made by an acceptable independent soils testing laboratory at the expense of the Contractor.

242.02 Gradation:

A. Crushed Limestone: When properly slaked and tested to TxDOT Flexible Base Requirements Item 247 Type A Grade 1 or 2. The flexible base material shall meet the following requirements:

Physical Requirements			
Grade 1		Grade 2	
Triaxial Class 1: Minimum Compressive Strength: 45 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure.		Triaxial Class 1: Minimum Compressive Strength: 35 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure.	
Master Grading		Master Grading	
1 3/4"	0	2 1/2"	0
7/8"	10-35	1 3/4"	0-10
3/8"	30-50	No.# 4	45-75
No.# 4	45-65	No.# 40	60-85
No.# 40	70-85		
Max. L.L.	35	Max. L.L.	40
Max. P.I.	10	Max. P.I.	12
Wet Ball Mill	Max. 40	Wet Ball Mill	Max. 45
Max. Increase in Passing No.# 40	20	Max. Increase in Passing No.# 40	20

Testing of flexible base materials shall be in accordance with the following TxDOT standard laboratory test procedures:

Moisture Content	Tex-103-E
Liquid Limit	Tex-104-E
Plasticity Index	Tex-106-E
Sieve Analysis	Tex-110-E
Moisture-Density Determination	Tex-113-E
Wet Ball Mill	Tex-116-E
Triaxial Tests	Tex-117-E

Tolerances unless otherwise shown on the plans, the limits established reasonable close conformity with the specified gradation and plasticity index are defined by the following:

Gradation. The City Engineer may accept the material, providing not more than one (1) out of the most recent (5) consecutive gradation tests performed are outside the specified limits for master grading, as applicable, on any individual sieve by no more than five (5) percentage points.

Plasticity Index. The City Engineer may accept the material providing not more than one (1) out of the most recent five (5) consecutive plasticity index samples tested are outside the specified limit by no more than two (2) percentage points.

Material. The material shall be rejected upon visual inspection should it contain an excessive amount of clay balls or roots.

243 Construction Methods

243.01 Preparation of the Subgrade: The subgrade shall be excavated or filled in conformity with the typical sections, to the line and grade established by the Engineer, thoroughly mixed, wetted or dried, and compacted in accordance with Section 220, "Roadway Excavation and Subgrade Preparation" of these specifications. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved materials and all holes, ruts and depressions shall be filled with approved materials. The surface of the subgrade shall be finished to line and grade as established by the Engineer and in conformity with the plans. Any deviation in excess of one-half (1/2") inch in cross section and in length of sixteen (16') feet measured longitudinally shall be corrected by loosening, adding or removing material, or reshaping and compacting by sprinkling and rolling. Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the work.

243.02 First Course: Immediately before placing the base material, the subgrade shall be approved for grade and compaction. Material deposited upon the subgrade shall be spread and shaped the same day. In the event inclement weather or unforeseen circumstances render impracticable the spreading of the material during the first twenty-four (24) hour period, the material shall be thoroughly mixed and spread as directed by the Engineer. No trenching of the flexible base will be allowed for the placement of curb. The curb shall be placed upon a completed section of base material as shown on the street cross section details. The material shall be sprinkled and bladed, dragged and shaped to conform to the typical section shown on the plans. All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be carefully and evenly incorporated with the material in place by scarifying, brooming or by other approved methods. The course shall then be thoroughly mixed and sprinkled as may be required to produce the optimum moisture of that material as determined by moisture-density relationships in accordance with TxDOT TEX 113-E Test Method. It shall then be rolled with an approved roller in accordance with Section 244, "Equipment" of the specifications, until a uniform compaction of at least 98% per TxDOT TEX 113-E Test Method is obtained.

When using a sheepsfoot roller, flat wheel roller, or vibratory steel roller, the deposited material shall not exceed 6" loose measurement in thickness. When using a pneumatic tire roller, deposited material shall not exceed 4" loose measurement in thickness. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical section shown on the plans and to the established lines and grades. In the area on which pavement is to be placed, any deviation in excess on one-fourth (1/4") inch in cross section and in length of sixteen (16') feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling. All irregularities, depressions, or weak spots which develop shall be immediately corrected by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

243.03 Succeeding Courses: Construction methods shall be the same as prescribed for the first course. The final course shall be four (4") inches in depth.

244 Equipment

244.01 Tamping Roller: Tamping (Sheepsfoot) rollers shall be a self-propelled roller capable of operating in a forward or backward motion. It shall have one or more tamping drums with an effective rolling width of not less than sixty (60) inches. Tamping drums shall be self-cleaning. Tamping feet shall project not less than three (3) inches from the surface of the drum. The load tamping foot shall exert a pressure of not less than 125 pounds per square inch nor more than 550 pounds per square inch in a static mode. Compaction in a vibratory mode will be permitted.

244.02 Pneumatic Tire Rollers: Pneumatic tire rollers shall consist of not less than seven (7) pneumatic wheels, running on axles in such manner that the rear group of tires will not follow in the tracks of the front group. The pneumatic tire roller shall have an effective rolling width of approximately 84 inches and shall be equipped with tires that will afford ground contact pressures to 80 pounds per square inch or more.

244.03 Vibratory Steel Rollers: Vibratory steel rollers shall be self propelled with at least one drum equipped to vibrate and be equipped with separate frequency and amplitude control for each vibrating drum. Vibratory steel rollers shall have the capability of starting and stopping the vibration manually and to continuously clean the face of the drum. The vibratory drum shall not be less than 20 inches wide.

244.04 Flat Wheel Steel Rollers: Flat wheel steel rollers shall be of the three-wheel, self-propelled type, weighing not less than ten (10) tons and shall provide a compression on the rear wheels of not less than 325 pounds per linear inch of tire width. All wheels shall be flat, the rear wheels shall have a diameter of not less than forty-eight (48) inches, and each shall have a tire width of not less than twenty (20) inches.

244.05 Alternate Equipment: In lieu of the equipment specified, the Contractor may, upon written permission from the City Engineer and City Public Works Inspector, operate other compacting equipment that will produce equivalent relative compaction. If the substituted equipment fails to produce the desired compaction, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

245 Testing

245.01 Minimum Requirements: The Contractor shall provide independent soils laboratory testing to determine the density curve of the flexible base material, and field testing of the completed flexible base to determine the completed density which shall be 98% of the optimum density in accordance with TxDOT TEX-113E Testor greater. There shall be at least one test every 100 lineal feet, per travelway, for each course of base applied. The thickness of the completed course shall be tested at least once every 500 lineal feet, per travelway.

250 Hot-Mix Asphaltic Concrete Pavement Base and Surface Courses

251 General

251.01 Description: This item shall consist of a surface course as shown on plans, composed of a compacted mixture of mineral aggregate and asphaltic material, mixed, transported, and placed on an approved tack coat.

251.02 Requirements: The surface course shall consist of Asphaltic Concrete (hot mix) meeting item 292 specifications of the Texas Department of Transportation's *Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges* 2014. A final asphaltic surface course shall consist of a minimum of two (2") inches (after compaction), of Type C or Type D Asphaltic Concrete (hot mix), meeting City specifications for material and installation.

252 Prime Coat

252.01 Asphalt Materials: The asphalt materials for prime coat shall conform to Cutback Asphalt MC-30, Emulsion MS-2, SS-1 or AE-P.

252.02 Water: Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

252.03 Dispersal Agent: Detergent shall be added to water and sprayed on surfaces to be primed in accordance to asphalt manufacturer's recommendations.

252.04 Construction Methods: When, in the opinion of the Engineer, the base course or other surface is satisfactory to receive the prime coat, the surface shall be cleaned by sweeping or other approved methods as directed by the Engineer. The surface shall be lightly sprinkled with water just prior to application of the asphaltic material unless the Engineer waives this requirement. The Contractor shall submit a list of prime materials to be applied to the Engineer for approval. When emulsions are approved, a dispersal agent shall be added to the water before sprinkling. The asphaltic material shall be applied on the clean surface by an approved type of self-propelled pressure distributor operated so as to distribute the prime coat at a rate ranging from .1 to .3 gallons per square yard of surface area. The distributor, when used for pay purposes, shall have been calibrated within three (3) years from the date it is first used on the project. The material shall be evenly and smoothly distributed. During the application of prime coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutters, or structures. The Contractor shall be responsible for cleaning splattered areas.

Prime Coat shall not be applied when the air temperature is below 60°F and falling, but it may be applied when the air temperature is above 50°F and rising. Asphaltic material shall not be placed when general weather conditions, in the opinion of the City Engineer and City Public Works Inspector, are not suitable.

The Contractor shall be responsible for the maintenance of the surface until the work is accepted by the City Engineer. No traffic, hauling or placement of any subsequent courses shall be permitted over the freshly applied prime coat.

253 Tack Coat

253.01 Description: This item shall consist of an application of asphaltic material on the completed base course after the prime coat has sufficiently cured, existing pavement, bituminous surface, bridge deck, or on a prepared surface as directed by the City Engineer and City Public Works Inspector.

253.02 Asphalt Materials: The asphalt material for "Tack Coat" shall meet the requirements for Cutback Asphalt or Emulsified Asphalt as listed below. Combining 50 to 70 percent by volume of the asphaltic material as specified for the type of paving mixture with 30 to 50 percent by volume of gasoline and/or kerosene shall make cutback asphalt. The type of mixture shall be selected from the following table:

Temp of Surface °F	
40 - 70	Over 70
RS-2	MS-2
RS-2H	MS-2H
RC-250	MC-70
CRS-2	CMS-2
CRS-2H	CMS-2H

253.03 Construction Methods: The surface upon which the tack coat is to be placed shall be cleaned thoroughly and 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 upon which it is to be placed without the use of a tack coat, the tack coat may be eliminated. All contact surfaces of curbs and structures and all joints shall be painted with a thin uniform application of tack coat. During the application of the tack coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutter and structures. The tack coat shall be rolled with a pneumatic tire roller when directed by the City Engineer and City Public Works Inspector.

Tack coat shall not be applied when the air temperature is below 50°F and falling, but it may be applied when the air temperature is above 40°F and rising, the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the City Engineer and City Public Works Inspector, are not suitable.

The distributor shall have been recently calibrated. After beginning of the work, should the yield on the asphaltic material applied appear in error, the distributor shall be calibrated in a manner satisfactory to the Engineer before proceeding with the work.

The contractor shall be responsible for maintenance of the surface until the HMAC is placed over the tack coat or the City Engineer accepts the work. No traffic, hauling, or placement of any subsequent courses shall be permitted over the freshly applied tack coat unless it is blotted by the application of sand as directed by the City Engineer and City Public Works Inspector.

All storage tanks, piping, retorts, booster tanks and distributors used in storing or handling asphaltic material shall be kept clean and in good operating condition at all times and they shall be operated in such a manner that there will be no contamination of the asphaltic material with foreign material. It shall be the responsibility of the Contractor to provide and maintain in good working order a recording thermometer at the storage heating unit at all times.

254 Hot-Mix Asphaltic Concrete Pavement Surface Course

254.01 Description: This item shall govern for the construction of a Type D surface course as shown on the plans, being composed of a compacted mixture of aggregate and asphalt cement mixed hot in a mixing plant, in accordance with the details shown on the plans and the requirements herein. Type C hot-mix may be substituted for Type D hot-mix when authorized by the Engineer.

254.02 Materials: Materials shall conform to Item 340, "Dense-Graded Hot-Mix Asphalt (Method)" of the Texas Department of Transportation's *Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges* 2014.

254.03 Mixture Design: The Contractor shall furnish the City Engineer with a mix design for approval. To substantiate the design, trial mixtures shall be produced and tested using all of the proposed project materials and equipment prior to any placement. The City Engineer may waive trial mixtures if similar designs have proven satisfactory.

254.04 Density: The mixture shall be designed to produce an acceptable mixture at an optimum density of 96.0 percent, when tested in accordance with Test Method Tex-207-F and Test Method Tex-227-F. The operating range for control of laboratory density during production shall be optimum plus or minus 1.5 percent. If the laboratory density of the mixture produced has a value outside the range specified, the Contractor shall investigate the cause and take corrective action.

254.05 Stability: The materials used in the mixture design shall produce a mixture with a stability value of at least 35 when tested in accordance with Test Method Tex-208-F. If during production, the stability falls below the specified minimum, the Engineer and the Contractor shall closely evaluate other test result values for specification compliance such as gradation, asphalt content, moisture content, etc. to determine the cause and take corrective action.

254.06 Master Grading Limits:

<u>Sieve</u>	<u>Type C</u>	<u>Type D</u>
7/8"	100	
5/8"	95-100	
1/2"		100
3/8"	70-85	85-100
1/4"		
No.4	43-63	50-70
No.10	30-40	32-42
No.40	10-25	11-26
No.80	3-13	4-14
No.200	1-6*	1-6*
VMA(%min)	13	14

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

254.07 Tolerances: The gradation of the aggregate and the asphalt cement content of the produced mixture shall not vary from the job-mix formula by more than the tolerances herein.

	Tolerance Percent by Weight Or Volume
Passing the 1-1/4" to No. 10 sieve	Plus or Minus 5
Passing the No. 40 to No. 200 sieve	Plus or Minus 3
Asphalt, weight	Plus or Minus 0.5
Asphalt, volume	Plus or Minus 1.2

254.08 Equipment: Contractor shall use TxDOT approved equipment. Refer to Texas Department of Transportation's *Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges* 2014.

254.09 Construction Methods:

A. General: It shall be the responsibility of the Contractor to produce, transport, place and compact the specified paving mixture in accordance with the requirements herein.

The asphaltic mixture, shall not be placed when the air temperature is below 50°F and is falling, but it may be placed when the air temperature is above 40°F and is rising. Mat thicknesses of 1-1/2" or less shall not be placed when the temperature of the surface on which the mat is to be placed is below 50°F.

It is further provided that the asphaltic mixture shall be placed only when general weather conditions and temperature and moisture condition of the base, in the opinion of the City Engineer and City Public Works Inspector, are suitable.

If after being discharged from the mixer and prior to placing, the temperature of the asphaltic mixture is 50°F or more below the selected discharge temperature, all or any part of the load may be rejected.

B. Transporting: The asphaltic mixture shall be hauled to the work site in tight vehicles previously cleaned of all foreign material. In cool weather or for long hauls, covering and insulating of the truck bodies may be required.

C. Placing: The asphaltic mixture shall be dumped and spread on the approved prepared surface with the spreading and finishing machine. The placing of the asphaltic mixture shall be done without tearing, shoving, gouging or segregating the mixture and without producing streaks in the mat.

Unloading into the finishing machine shall be controlled so that bouncing or jarring of the spreading and finishing machine shall not occur and the required lines and grades shall be obtained without resorting to hand finishing.

Unless otherwise shown on the plans, dumping of the asphaltic mixture in a windrow and then placing the mixture in the finishing machine with windrow pick-up equipment will be permitted. Any operation of the windrow pick-up equipment resulting in the accumulation and subsequent shedding of accumulated material into the asphaltic mixture will not be permitted.

The spreading and finishing machine shall be operated at a uniform forward speed consistent with the plant production rate, hauling capability, and roller train capacity to result in a continuous operation.

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

D. Compacting: The pavement shall be compacted thoroughly and uniformly with the necessary rollers to obtain the compaction and cross-section of the finished paving mixture meeting the requirements of the plans and specifications.

When rolling with steel wheeled rollers, rolling shall start by first rolling the joint with the adjacent pavement and then continue by rolling longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least one foot. Alternate trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side.

Vibratory rollers shall not be left vibrating while not rolling or when changing directions. Vibratory rollers shall not be allowed in the vibrating mode on mats with a plan depth of less

than 1-1/2 inches.

The motion of the rollers shall be slow enough to avoid other than usual displacement of the mixture. The roller shall not be allowed to stand on pavement which has not been fully compacted.

The edges of the pavement along curbs, headers and similar structures, and all places not accessible to the roller, shall be thoroughly compacted with lightly oiled tamps.

All rolling for compaction shall be completed before the mixture temperature drops below 175°F.

255 Testing

255.01 Minimum Requirements: No asphaltic concrete shall be placed without the presence of City Public Works Inspector. Testing for laboratory density, stability, percent asphalt, gradation, and moisture content will be required for each day’s production. In place densities shall be taken at intervals of one per block or as the inspector determines based on the construction site.

255.02 Ride Quality: All irregularities shall be corrected at the contractor’s expense. Irregularities shall be any variation of the surface from the testing edge of the straightedge which exceeds 1/8” between any two contacts, longitudinally or vertically.

255.03 Final Acceptance: If the surface ravel, flushes, ruts or deteriorates in any manner prior to final acceptance of the work, it will be the Contractor’s responsibility to correct this condition at his expense, to the satisfaction of the Engineer and in conformance with the requirements of this specification.

260 Surface Treatments

261 General

261.01 Description: This item shall consist of a surface treatment composed of a single, double or triple application of asphalt material, each covered with aggregate for the sealing of existing pavements in accordance with these specifications.

261.02 Materials: The materials used under this specification shall meet the following requirements:

A. Asphaltic Material: Asphalt oil shall be AC-15-P or approved equal and shall meet the requirements of the Texas Department of Transportation’s *Standard Specifications for Construction of Highways, Streets, and Bridges*, Item 300, “Asphalts, Oils, and Emulsions”.

B. Aggregates: The aggregate shall be pre-coated grade 4 aggregate and the aggregate, placement, and storage methods shall conform to the Texas Department of Transportation’s *Standard Specifications for Construction of Highways, Streets, and Bridges*, Item 302, “Aggregates for Surface Treatments”.

C. Application Rates: The application rate for the surface treatment shall be as follows:

<u>Asphalt Rate, (GAL/SY)</u>	<u>Aggregate Rate, (CY/SY)</u>
0.30	1:90 – 1:100

262 Construction Methods

Construction methods for the placement of the seal coat shall meet the requirements of Item 316 of the Texas Department of Transportation’s *Standard Specifications for Construction of Highways, Streets,*

and Bridges.

262.01 Stockpiles: Stockpiles should only be permitted at a location approved by the City. Temporary stockpiling of aggregates on the right of way will be permitted, provided that the stockpiles are so placed as to allow for the safety of the traveling public and not obstruct traffic or sight distance, and do not interfere with access from abutting property, nor with roadway drainage. Location of stockpiles shall be either a minimum of 30 feet from the edge of the travel lanes or shall be signed and barricaded. Prior to final acceptance, the Contractor shall remove remaining aggregate stockpiles.

262.02 Temperature: Surface treatments shall not be applied when the air temperature is below 60°F and is falling, but may be applied when the air temperature is above 50°F and is rising. Surface treatments shall not be applied when the temperature of the surface on which the surface treatment is to be applied is below 60°F.

262.03 Preparation: The area to be treated shall be cleaned of all dirt, dust or other deleterious matter by sweeping or other approved methods. Manholes, valve boxes, grate inlets, and other utility access devices shall be protected from the surface treatment by placement of plywood discs or other approved materials. Button covers or another approved method shall be used to protect the existing raised pavement markers. The inspector shall approve the surface preparation prior to treatment.

262.04 Placing: The applied seal coat shall be rolled for its entire width with a multiple wheel self propelled pneumatic tire roller with provisions for loading up to 10 tons. Rolling shall begin longitudinally at the edges of the mat and progress towards the center, uniformly lapping each preceding track by at least ½ the width of the roller and be repeated as often as necessary to thoroughly key the cover aggregate into the bitumen over the entire surface. Aggregate impediment in the bitumen shall be 95%. The width of each application of asphaltic material shall be such to allow uniform application and immediate covering with aggregate. Paper or other suitable material shall be used to prevent overlapping of transverse joints. Longitudinal joints shall match lane lines. The finished surface shall be cleared of any surplus aggregate by the Contractor by sweeping or other approved methods after all rolling is completed.

All holes or failures in the seal coat surface shall be repaired by use of additional asphalt and aggregate and all fat or bleeding surfaces shall be covered with approved cover material in such manner that the asphaltic material will not adhere to or be picked up on the wheels of vehicles. This maintenance will continue until the bleeding has stopped. Final acceptance of the project will occur after all excess rock is removed from project areas and all streets have been swept with approved sweeper.

270 Portland Cement Concrete Pavement

271 General

271.01 Description: This item shall consist of a surface course as shown on plans, composed of Portland Cement Concrete.

271.02 Requirements: The surface course shall consist of a minimum of six (6") inches of Portland Cement Concrete, meeting City specifications for material and installation. Portland Cement Concrete surface course shall be installed with a crown of five (5") inches, measured from the gutter elevation to the centerline of the paved section.

271.03 Paving Construction Plan: The Contractor shall submit a paving construction plan for approval by the City Engineer prior to beginning pavement construction operations. The plan shall contain the mix design, methods of construction, description of equipment to be used in mixing, placing, finishing, curing, lighting and miscellaneous materials, and early usage of concrete pavement. The plan also shall include location, sequence, and construction methods for leaveouts if applicable.

272 Materials

272.01 Portland Cement Concrete: Concrete shall conform to the requirements of Section 900 "Concrete and Structures". Classification and mix design shall conform to Class P concrete as defined in Section 900.

272.02 Joint Sealants: Unless otherwise shown on the plans, the joint sealant material shall be a Class 5 Self-leveling Low Modulus Silicone. The backer rods shall be compressible type materials, such as closed-cell, resilient foam or sponge rubber stock of vinyl, butyl or neoprene, or expanded polyethylene or polyurethane. The diameter of the backer rod shall be at least 25 percent larger than the joint reservoir width.

272.03 Dowels for Expansion and Contraction Joints: Dowels shall be smooth, straight steel dowels of the size and type shown on the plans and shall conform to the requirements of ASTM A615, Grade 60. Unless otherwise shown on the plans, the entire length of each dowel shall be coated with hot applied asphalt cement. The asphalt coated end of each dowel to be used in an expansion joint shall be encased in an approved cap.

272.04 Positioning and Support Devices for Reinforcement and Joint Assemblies: These devices shall be of sufficient structural quality to prevent movement of the dowels or steel reinforcement during concrete placement and finishing.

Positioning and support devices (chairs) for steel reinforcement bars shall be either plastic or metal and of sufficient number to maintain the position of the bars within the allowable tolerances.

The support devices shall secure the joint assembly and dowels within the allowable tolerances while providing no restraint against joint movement. Dowels used in joint assemblies shall be secured in a parallel position by a transverse metal brace of the type and design shown on the plans.

272.05 Reinforcing Steel: ASTM A616 Grade 60 will be permitted for straight bars only. Reinforcing steel that requires bending shall be ASTM Grade 40 with the spacing reduced to 2/3 of that shown for Grade 60

A. Tie Bars: Tie bars at weakened plane longitudinal joints shall be straight reinforcing bars. Tie bars at longitudinal construction joints shall be either multiple piece tie bars or straight reinforcing bars.

B. Multiple Piece Tie Bars: Multiple piece tie bars (threaded coupling or other adequate devices) shall develop a tensile strength over the entire length equal to 1 ¼ times the yield strength of the tie bars shown. Each end of multiple piece tie bars shall consist of deformed reinforcement of at least the size shown on the plans. The deformed section of each end of the multiple piece tie bars shall be at least 1/2 the length of the tie bars shown on the plans. Unless otherwise shown on the plans, the spacing for the multiple piece tie bars shall be equal to or less than that of the transverse bars shown.

272.06 Curing Material: Curing material shall conform to Type 2 Class A curing compound.

273 Equipment

273.01 General: All equipment shall be maintained in good condition and approved by the City Engineer before the Contractor will be permitted to begin construction of the pavement. When concrete pavement is not formed, equipment used in the spreading and finishing of concrete pavement shall be designed to be operated on a prepared track grade controlled by electronic sensor systems. The systems used on a prepared track grade shall operate from an adequately supported string line or equivalent system approved by the Engineer.

273.02 Forms: Side forms shall be of metal except as otherwise provided herein and shall be of approved cross section. The length of form sections shall not be less than 10 feet, and each section shall provide for staking in position with not less than three (3) pins. Forms shall be of ample strength and shall be provided with adequate devices to secure them in place so the forms will withstand, without visible springing or settlement, the impact and vibration of the spreading and finishing machinery.

In no case shall the base of the form be less than eight (8) inches wide for a form depth of eight inches or more in height. The forms shall be free from warps, bends or kinks, and shall be sufficiently true to provide a reasonably straight edge on the concrete.

Flexible or curved forms of wood or metal of proper radius shall be used for curves of 100 foot radius or less.

The preferred depth of the form shall be equal to the required edge thickness of the pavement. Forms with depth greater or less than the required edge thickness of the pavement will be permitted provided the difference between the form depth and the edge thickness is not greater than two (2) inches, and further provided that:

- A. Forms of a depth greater than the pavement edge may be used if the supporting material is planed to construct a form trench.
- B. Forms of a depth less than the pavement edge shall be brought to the required edge thickness by securely attaching metal strips or wood shims of approved section to the full width and length of the base of the form.

Outside curb forms shall be of wood or metal, straight, free of warp, and shall be of a depth at least equal to the depth of the curb. They shall be securely mounted on the paving forms and maintained in true position during the placing of concrete.

273.03 Concrete Spreader: A mechanical concrete spreader shall conform to the following requirements:

- A. Be a self propelled machine having sufficient power and traction to spread and strike off concrete without slippage,
- B. Be equipped with a power driven device, either a reciprocating blade, screw conveyor or a belt conveyor, for spreading the concrete uniformly,
- C. And be capable of striking off the concrete slab at the depth and grade required.

273.04 Slipform Paver: Slipform pavers shall be equipped to spread the concrete uniformly and strike off the concrete to the required section, using a power driven device, either a reciprocating blade, a screw conveyor, or a belt conveyor, without loss of traction.

The slipform paver shall have an electronic sensor system or equivalent to provide grade control for the paver. The slipform paver shall be equipped with consolidation equipment.

273.05 Floats: Floats shall be either mechanically operated oscillating longitudinal floats or tube floats capable of producing a uniformly smooth surface. Tube floats shall be designed to operate at an angle of greater than 30 degrees from normal when rotated in either direction. The tube float shall be equipped to provide a fine light fog mist.

273.06 Vibrators: Immersion vibrators shall be spaced at not more than 24 inches and shall be equipped with synchronized vibratory units. Approved hand operated immersion vibrators shall be furnished in sufficient number for proper consolidation of the concrete along forms, at joints and in

areas not covered by mechanically controlled vibrators. Pan vibrators shall apply vibration directly to the surface of the concrete.

273.07 Finishing Equipment: Contractor shall use TxDOT approved equipment. Refer to Texas Department of Transportation's *Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges* 2014.

274 Quality of Concrete

274.01 Requirements: The quality of concrete shall be in accordance with Section 900 "Concrete and Structures", and the additional requirements herein:

Additional flexural strength test specimens may be made as required by concrete placing conditions or for adequately determining the strength of the concrete where the early opening of the pavement to traffic is dependent on concrete strength tests. For early opening to traffic, the flexural strength specimens shall be cured at the same time and in the same manner as the pavement.

275 Subgrade, Subbase, and Forms

275.01 Requirements: The concrete pavement shall be constructed on a prepared surface as shown on the plans. When slipform equipment is used, a firm subgrade or subbase shall be maintained outside the limits of the pavement for the support of the slipform equipment.

The subgrade or subbase shall be maintained in a smooth, compacted condition until the pavement is placed and shall be kept thoroughly wetted sufficiently in advance of placing any pavement. All damage to the prepared subgrade shall be corrected by the Contractor at the Contractor's expense.

The subgrade under the forms shall be firm and cut to grade so that each form section is firmly in contact with the subgrade for its whole length and base width. When minor irregularities exist, forms shall be leveled using a stabilized, sufficiently plastic, material to fill the voids underneath the side forms. Paving equipment will not be permitted on the forms until the stabilized material has cured completely.

All adjustments to the plan gradeline will require written approval of the City Engineer.

276 Joints

276.01 Sawed Joints: All joints shall be sawed and sealed before placing concrete in adjacent lanes and before permitting traffic to use the pavement.

When sawed joints are used, they shall be sawed to the depth as shown on the plans as soon as sawing can be accomplished without damage to the pavement. Once sawing has commenced it shall be continued until completed. All sawing must be completed within 12 hours of placement. Sawing must be accomplished even in rain and cold weather.

The part of the seal of the curing compound which has been disturbed by sawing operations shall be resprayed by the Contractor.

The transverse weakened plane joints shall be formed or sawed perpendicular to the centerline and surface of the pavement.

276.02 Construction Joints: When the placing of concrete is stopped, a bulkhead of sufficient cross sectional area to prevent deflection, accurately notched to receive the load transmission devices and shaped accurately to the cross section of the pavement shall be provided.

Intentional stoppage of the placing of the concrete shall be at either an expansion joint or a weakened

plane joint.

Joints in the curb shall be of the same type and location as the adjacent pavement. The expansion joint material shall be of the same thickness, type and quality as specified for the pavement.

When transverse sawed joints are provided for the pavement, the curb placement shall be delayed until the transverse joints in the pavement have been sawed. Dowel bars shall be placed while the pavement is still plastic. The weakened plane joint in the monolithic curbs may be formed or sawed.

277 Construction Methods

277.01 Finishing: Machine-finishing of pavement shall include the use of power-driven spreaders, power driven vibrators, power driven strike-off, and screed.

The transverse finishing of pavement shall be operated to compact and strike-off the concrete to the required section and grade, without surface voids. The machine shall be operated over each area as many times and at such intervals as needed to consolidate and shape the surface. After completion of finishing with the transverse finishing machine a float may be used.

The Contractor shall perform sufficient checks with a long handled 10-foot straightedge on the plastic concrete to insure that the final surface will be within the tolerances specified below. The check shall be made with the straightedge parallel to the centerline. Each pass shall lap half of the preceding pass. All high spots shall be removed and all depressions over 1/16 inch in depth shall be filled with fresh concrete and floated.

Final finish shall consist of a combination of a carpet drag and metal tine finish. Final finish shall be completed before the concrete has attained its initial set. Successive passes of the tines shall not overlap a previous pass. After completion of texturing, the edge of the slab and joints shall be carefully finished.

The Contractor shall have available at all times hand operated tining equipment and hand operated carpet drags for the purpose of providing texture in the event of equipment breakdown.

277.02 Curing: After final finish and immediately after free moisture has disappeared, the concrete surface shall be sprayed uniformly with curing compound. Special care shall be taken to insure that the sides of the tining grooves are coated with curing compound. All concrete pavement shall be cured for a period of not less than 72 hours from the beginning of curing operations.

277.03 Opening to Traffic: The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least four days old. At the end of this period the pavement may be opened for use by vehicles of the Contractor provided the gross weight of such vehicles and/or equipment does not exceed 14,000 pounds. On those sections of the pavement to be opened to traffic, all joints shall first be sealed and the pavement cleaned. Stable material shall be placed against the pavement edges before permitting vehicles thereon.

After the concrete in any section of pavement is seven (7) days old, such section of pavement may be opened to traffic. When an occasional crossing of overweight equipment is permitted, temporary matting or other methods may be required.

278 Testing

278.01 Minimum Requirements: The Contractor shall provide independent lab testing to determine compliance to these specifications. One strength test shall be taken for every 50 cubic yards or fraction thereof. Testing for slump and air content shall be performed for each set of strength specimens. Testing for thickness compliance shall be done by the city's construction inspector at the time of placement at least every 500 lineal feet per travelway.

Any area of pavement found deficient in thickness by more than one (1) inch or more than 1/8 of the plan thickness, whichever is greater, shall be evaluated by the City Engineer.

280 Concrete Curb and Gutter

281 Description: This section consists of Portland Cement concrete curb and gutter with Grade 60 reinforcing steel conforming to ASTM A-615; constructed over a compacted subgrade and at least 2" of compacted flexible base, all in accordance with these specifications and in conformity with the lines and grades approved by the City Engineer.

282 Materials: Materials and proportions for concrete used in construction under this section shall conform to the requirements as specified under the pertinent sections of these specifications (Section 900, Concrete Construction).

283 Construction Methods:

- A. Subgrade: The subgrade shall be excavated, compacted, and shaped to line, grade, and cross section in accordance with these specifications and in conformity with the lines and grades provided by the Engineer. For residential streets, a minimum of 2" of flexible base shall be placed as shown in the street cross section details. For Collector and Arterial streets a minimum of 2" of Type 'B' asphalt base shall be used under the curb and gutter as shown in the street cross section details. If flexible base is being used under an asphalt surface then after the curb and gutter has been placed and cured the remaining flexible base shall be placed at the thickness required to conform to the lines and grades shown on the plans.
- B. Forms: All forms shall meet the requirements as specified under Section 920.08. When extruded or slipformed concrete is used for curb and gutter placement, the concrete shall be placed with self-propelled equipment. The line shall be maintained from a guideline set by the Contractor based on the alignment data shown on the plans. The outline shall strictly conform to the details shown on the plans. The forming tube of the extrusion machine or the form of the slipform machine shall be readily adjustable vertically during the forward motion of the machine to provide required variable heights necessary to conform to the established grade line.
- C. Reinforcing Steel: The reinforcing steel shall be placed in position and of the diameter shown on the typical section. All steel shall be kept in its proper placement and position, without contact with the forms, the ground, or joint material. All reinforcing steel shall be grade 60 unless otherwise indicated.
- D. Mixing, Placing, and Finishing Concrete: Concrete for curb and gutter shall be mixed in a manner satisfactory to the Engineer. It shall be poured in sections of length indicated on the standard detail on an approved material to cross sections specified for the curb and gutter, and of the required thickness.
- E. Curing: The completed curb and gutter shall be cured as specified with one of the methods in Section 921. Acceptable curing compounds, if applied in accordance to manufacturer's specifications, may be used in lieu of mats or burlap. The back of the curb shall be cured in the same manner as the face of the curb and gutter.
- F. Compaction: The fill material placed behind the curb shall be compacted to **at least 95%** of the optimum density in accordance with TxDOT TEX-114E Test Method for a distance 10' or a distance that shall be determined by the City Engineer or City Public Works Inspector.
- G. Expansion Joints: Expansion joints shall be placed perpendicular to the centerline of the street at eighty (80') foot intervals, and at the P.C. and/or P.T. of a curve or return into an intersection. Furthermore, curb and gutter will be scored at ten (10') foot intervals.
- H. Expansion Joint Material: Joint Material shall be asphalt-impregnated fiber-board. The joint material shall be the full depth of the concrete across its full width, a minimum thickness of 0.5".
- I. Dowel Bars: Dowel Bars shall be No. 4 smooth steel bars placed through each expansion joint and

at “cold” pour joints. To allow horizontal, longitudinal movement, each bar shall have one end enclosed in an acceptable cap, wrapped in asphaltic felt, or adequately greased for a full twelve (12”) inch length to the expansion joint material.

284 Alternate Curb Design: Submittals for alternate curb designs will be reviewed individually by the City Engineer for approval as an alternate to the City Specified Standard Curb Detail.

290 Street Lights

291 Basic Policy: It shall be the policy of the City of Burnet that adequate street lighting for the protection of the public and property be installed in all new subdivisions. Installation procedures and acceptable standards for street lights shall be governed by the utility standards in effect at the time of subdivision construction or additional thereto.

292 General Standards:

- A. The actual number of street lights to be required, as well as the type and size of luminaire, and the installation location and size of street light services, shall be determined by the City Engineer. Pole type for mounting of street lights shall be selected by the developer, subject to the approved street light pole standards of the Burnet Utility Services.
- B. Street lights shall normally be required at all street intersections and access ways, in cul-de-sacs, and at generally 300 foot intervals or less on tangent streets.

292 Street Lighting Requirements For Residential Rural Subdivisions: Notwithstanding the above requirements, Residential Rural Subdivisions shall be subject to the following street lighting requirements:

- A. The installation of street lights shall be required at the main entrance to the subdivision. The type, size of luminaire, location, size of street light service and installation shall be determined by the City Engineer.
- B. To allow for future installation of street lights the developer shall be responsible for the installation and capping of electrical conduits at all street intersections.