CITY OF SAN ANTONIO, TEXAS
GOVERNING SPECIFICATIONS

All standard specifications and special specifications applicable to this project are identified as follows:

CITY OF SAN ANTONIO
STANDARD SPECIFICATIONS FOR CONSTRUCTION (JUNE 2008)

ITEM NO.	DESCRIPTION
100	MOBILIZATION
101	PREPARING RIGHT-OF-WAY
103	REMOVE CONCRETE
104	STREET EXCAVATION
203	TACK COAT
208	SALVAGING, HAULING & STOCKPILING RECLAIMABLE ASPHALTIC PAVEMENT
230	BASE AND PAVEMENT REPLACEMENT
240	WARM MIX ASPHALT CONCRETE
308	DRILLED SHAFTS AND UNDER-REAMED FOUNDATIONS
500	CONCRETE CURB, GUTTER AND CONCRETE CURB AND GUTTER
526	FIELD OFFICE
530	BARRICADES, SIGNS, AND TRAFFIC HANDLING
531	SIGNS
535	HOT APPLIED THERMOPLASTIC PAVEMENT MARKINGS
537	RAISED PAVEMENT MARKERS
540	TEMPORARY EROSION, SEDIMENTATION AND WATER POLLUTION PREVENTION AND CONTROL
618	CONDUIT
620	ELECTRICAL CONDUCTORS
624	GROUND BOXES
628	ELECTRICAL SERVICES
636	ALUMINUM SIGNS
680	INSTALLATION OF HIGHWAY TRAFFIC SIGNALS
682	VEHICLE AND PEDESTRIAN SIGNAL HEADS
684	TRAFFIC SIGNAL CABLES
685	FLASHING BEACON ASSEMBLIES
686	TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)
691	SPREAD SPECTRUM RADIOS FOR TRAFFIC SIGNALS

CITY OF SAN ANTONIO
SPECIAL PROVISIONS TO THE STANDARD SPECIFICATIONS FOR CONSTRUCTION
(JUNE 2008)

ITEM NO.	DESCRIPTION
526	FIELD OFFICE

TEXAS DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES 2024

ITEM NO.	DESCRIPTION
503	PORTABLE CHANGEABLE MESSAGE SIGN

SAN ANTONIO WATER SYSTEM (SAWS)
STANDARD SPECIFICATIONS FOR CONSTRUCTION (FEBRUARY 2021)

ITEM NO.	DESCRIPTION
826	EXISTING VALVE BOX ADJUSTMENTS

DIVISION I - EARTHWORK

ITEM

100 MOBILIZATION

100.1. DESCRIPTION: *Establish and remove offices, plants, and facilities. Move personnel, equipment, and supplies to and from the project or the vicinity of the project site to begin work or complete work on Contract Items.*

100.2. MEASUREMENT: This Item will be measured by the lump sum as the work progresses.

100.3. PAYMENT: Partial payments of the lump sum bid for mobilization will be as follows. The adjusted Contract amount for construction Items as used below is defined as the total Contract amount less the lump sum for mobilization.

A. Payment will be made upon presentation of a paid invoice for the payment bond, performance bond, and required insurance. The combined payment for bonds and insurance will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.

B. Payment will be made upon verification of documented expenditures for plant and facility setup. The combined amount for all these facilities will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.

C. When 1% of the adjusted Contract amount for construction Items is earned, 50% of the mobilization lump sum bid or 5% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.

D. When 5% of the adjusted Contract amount for construction Items is earned, 75% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under the Item will be deducted from this amount.

E. When 10% of the adjusted Contract amount for construction Items is earned, 90% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.

F. Payment for the remainder of the lump sum bid for "Mobilization" will be made on the next estimate cycle after the initial retainage estimate or at final acceptance for projects without retainage.

100.4. BID ITEM:

Item 100.1 - Mobilization - lump sum

Item 100.2 - Insurance and Bond - lump sum

ITEM

101 PREPARING RIGHT-OF-WAY

101.1. DESCRIPTION: *Prepare the right of way and designated easements for construction operations by removing and disposing of all obstructions when removal of such obstructions is not specifically shown on the plans to be paid by other Items.*

101.2. MATERIALS:

A. Obstructions. Obstructions shall be considered to include, but not limited to, remains of houses not completely removed by others, foundations, floor slabs, concrete, brick, lumber, plaster, cisterns, septic tanks, basements, abandoned utility pipes or conduits, equipment or other foundations, fences, retaining walls, outhouses, shacks, and all other debris as well as buried concrete slabs, curbs, gutters, driveways, and sidewalks.

This item shall also include the removal of trees, stumps, bushes, shrubs, brush, roots, vegetation, logs, rubbish, paved parking areas, miscellaneous stone, brick, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron and all debris, whether above or below ground, except live utility facilities.

It is the intent of this specification to provide for the removal and disposal of all obstructions to the new construction together with other objectionable materials not specifically provided for elsewhere by the plans and specifications.

B. Explosives. This item shall not govern for the demolition of buildings by the use of explosives. Such demolition work shall be governed by the use of a special specification controlling the work.

C. Fences. Unless shown otherwise on the plans, all fences along the right-of-way which are damaged or removed temporarily by the Contractor shall be replaced by the Contractor to an equal or better condition at no additional cost to the City.

D. Hazardous Materials. If the Contractor encounters hazardous substances, industrial waste, other environmental pollutants, underground storage tanks, or conditions conducive to environmental damage, Contractor shall immediately stop work in the area affected and report the condition to the Owner's representative in writing. Contractor shall not be responsible for or required to conduct any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work of any kind or nature (the "remedial work") under any applicable level, state or federal law, regulation or ordinance, or any judicial order. If the Contractor agrees in writing to commence and/or prosecute some or all of the remedial work, all costs and expenses, to include any extension of the contract time, of such remedial work shall be paid by Owner to Contractor as additional compensation.

101.3. EQUIPMENT: Provide applicable equipment to conduct work as described in this specification or as specified on the plans.

101.4. CONSTRUCTION: Protect designated features on the right of way and prune trees and shrubs as directed. Do not park equipment, service equipment, store materials, or disturb the root area under the branches of trees designated for preservation. When shown on the plans, treat cuts on trees with an approved tree wound dressing within 20 min. of making a pruning cut or otherwise

causing damage to the tree. Follow all local and state regulations when burning. If burning of brush is approved, pile and burn at approved locations. When working in state or national forests or parks, coordinate work with state and federal authorities. Testing, removal, and disposal of hazardous materials will be in accordance with 101.2.D, "Hazardous Materials."

Clear areas shown on the plans of all obstructions, except those landscape features that are to be preserved. Such obstructions include but are not limited to those identified in 101.2.A, "Obstructions" and other items as specified on the plans. Remove vegetation and other landscape features not designated for preservation. Removal of live utility facilities is not included in this Item. Remove culverts, storm sewers, manholes, and inlets in proper sequence to maintain traffic and drainage.

Unless otherwise indicated on the plans, all underground obstructions shall be removed to the following depths:

- In areas receiving embankment, remove obstructions not designated for preservation to 2 ft. below natural ground.
- In areas to be excavated, remove obstructions to 2 ft. below the excavation level.
- In all other areas, remove obstructions to 1 ft. below natural ground.

When allowed by the plans or directed, cut trees and stumps off to ground level.

Holes remaining after removal of all obstructions, objectionable materials, vegetation, etc. shall be backfilled and tamped and the entire area bladed, to prevent ponding of water and to positive provide drainage. Backfill materials deemed unacceptable by the Engineer shall be removed and replaced at no additional cost to the City. In areas that are to be immediately excavated, backfilling and blading may be eliminated if approved by the Engineer. Areas to be used as borrow sites and material sources shall have all obstructions, objectionable materials, vegetation, etc., removed to the complete extent necessary to prevent such objectionable matter from becoming mixed with the material to be used in the construction.

Where a conduit is shown to be replaced, it shall be removed in its entirety and all connections to the existing conduit shall be extended to the new line. Where an existing conduit is to be cut and plugged, the line shall be cut back not less that 2 feet and a plug of concrete not less that 2 feet long shall be poured and held in the end of the pipe or the plug may be accomplished by using a precast stopper grouted into place.

Material to be removed will be designated as "salvageable" or "non-salvageable" on the plans prior to bidding by the Contractor. All "salvageable" material will remain the property of the City and will be stored at the site as directed by the Engineer. All "non-salvageable" materials and debris removed shall become the property of the Contractor and shall be removed from the site and shall be disposed of properly and in accordance with local, state, and federal requirements.

All asphaltic material shall be deposited of or recycled at a facility authorized to accept the asphalt for such purposes.

Dispose of wells in accordance with TxDOT Item 103, "Disposal of Wells."

101.5. MEASUREMENT: "Preparing Right-of-Way" for new construction will be measured by the lump sum.

101.6. PAYMENT: This item will be paid for at the contract lump sum price bid for "Preparing Right-of-Way," which price shall be full compensation for work herein specified, including the furnishing of all materials, equipment, tools, labor, and incidentals necessary to complete the work. The lump sum price will be pro-rated based on the number of phases in the project. A phase will be eligible for payment when street excavation is completed for that phase.

101.7. BID ITEM:

Item 101.1 - Preparing Right-of-Way - lump sum

ITEM

103 REMOVE CONCRETE

103.1. DESCRIPTION: *This item shall govern the breaking up, removing, and satisfactorily disposing of existing concrete, as classified, at locations shown on the plans or as directed by the Engineer. Existing concrete not shown on the plans, located beneath the natural ground surface, not indicated by the Engineer or not obvious to the naked eye will not be covered under this item. Such materials will be removed as needed and paid for under Item 104 "Street Excavation," Item 105 "Channel Excavation," or Item 306 "Structural Excavation."*

103.2. CLASSIFICATION: Existing concrete to be removed under this item will be classified as follows:

A. Concrete Curb. "Concrete Curb" will include curb, curb and gutter, and low curb at driveways, and combinations thereof. The removal of monolithic concrete curb or dowelled concrete curb will be included in the concrete pavement measurement.

B. Concrete Traffic Barrier. "Concrete Traffic Barrier" will include permanent concrete barrier used for channeling or dividing traffic that is not considered salvageable.

C. Sidewalks and Driveways. "Sidewalks and Driveways" will include concrete sidewalks and driveways.

D. Miscellaneous Concrete. "Miscellaneous Concrete" will include all other items that are not noted above or covered by other items.

103.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

103.4. CONSTRUCTION:

A. General. The existing concrete shall be broken up, removed, and disposed of by the Contractor in accordance with federal, state, and local regulations.

B. Partial Removal of Concrete. When only a portion of the existing concrete is to be removed, care shall be exercised to avoid damage to that portion to remain in place. The existing concrete shall be cut to neat lines shown on the plans or as established by the Engineer, by sawing with an appropriate type circular concrete saw to a minimum depth of ½-inch. Any existing concrete which is damaged or destroyed beyond the neat lines so established shall be replaced at the Contractor's expense. Where reinforcement is encountered in the removed portions of the concrete, a minimum of 1-foot shall be cleaned of all old concrete and left in place to tie into the new concrete construction.

103.5. MEASUREMENT: Measurement for this item will be conducted as follows:

A. Concrete Curb. Concrete curb removed as prescribed above will be measured by the linear foot in its original position regardless of the thickness and reinforcing steel encountered.

B. Concrete Traffic Barrier. Concrete Traffic Barrier as prescribed above will be measured by the linear foot in its original position regardless of the type or size encountered.

C. Concrete Sidewalk and Driveway. Concrete sidewalks and driveways removed as prescribed above will be measured by the square foot in its original position regardless of the thickness of the concrete and reinforcing steel encountered.

D. Miscellaneous Concrete. Miscellaneous Concrete will be measured by the square foot in its original position regardless of the thickness of the concrete and reinforcing steel encountered.

103.6. PAYMENT: This item will be paid for at the contract unit price bid for "Remove Concrete Curb," "Remove Concrete Traffic Barrier," "Remove Concrete Sidewalks and Driveways," or "Remove Miscellaneous Concrete" which price shall be full compensation for all work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

103.7. BID ITEM:

Item 103.1 - Remove Concrete Curb - per linear foot

Item 103.2 - Remove Concrete Traffic Barrier - per linear foot

Item 103.3 - Remove Sidewalks and Driveways - per square foot

Item 103.4 - Remove Miscellaneous Concrete - per square foot

ITEM

104 STREET EXCAVATION

104.1. DESCRIPTION: *Excavate and properly dispose all excavated material, of whatever character, within the limits of the work and construct, compact, shape and finish earthwork on the entire length of the street, approaches, and/or sidewalk in accordance with specification requirements herein outlined and in conformity with the required lines, grades, and typical cross sections, shown on the plans or directed by the Engineer.*

104.2. MATERIALS: All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed, except those covered by other pay items.

A. Hazardous Materials. If the Contractor encounters hazardous substances, industrial waste, other environmental pollutants, underground storage tanks, or conditions conducive to environmental damage, Contractor shall immediately stop work in the area affected and report the condition to the Owner's representative in writing. Contractor shall not be responsible for or required to conduct any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work of any kind or nature (the "remedial work") under any applicable level, state or federal law, regulation or ordinance, or any judicial order. If the Contractor agrees in writing to commence and/or prosecute some or all of the remedial work, all costs and expenses, to include any extension of the contract time, of such remedial work shall be paid by Owner to Contractor as additional compensation.

B. Existing Structures/Obstructions. Removal of structures and other obstructions prior to excavation and finishing of all other earthwork described herein shall be completed and paid for in accordance with Item 101, "Preparing Right-of-Way" unless otherwise stated on the plans.

C. Existing Asphaltic Materials. All asphaltic material shall be disposed of or recycled at a facility authorized to accept the material for such purposes.

104.3. EQUIPMENT: Provide applicable equipment to conduct work as described in this specification or as specified on the plans.

104.4. CONSTRUCTION: The subgrade shall be shaped in conformity to the lines and grades established by the Engineer by removal of existing material or addition of approved material. Material removed in one area may be utilized in the addition of material to the subgrade in another area if approved by the Engineer. All material required for completion of the subgrade shall be subject to approval by the Engineer.

Unsuitable excavation or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor and it shall become his sole responsibility to dispose of this material off the limits of the right-of-way. Proper disposal shall be in conformance with, but not limited to, the following provisions:

- Do not deposit excavated material within jurisdictional wetlands, and

- Obtain appropriate permits and apply provisions pertaining to soil erosion and stream pollution, when necessary, to meet federal and/or local regulations, rules, and procedures.

A. Rock Cuts. Excavate to finished subgrade elevation using equipment appropriate for the conditions encountered. Manipulate and compact subgrade in accordance with Section 104.4.C., "Compaction," unless excavation is to clean homogenous rock at finished subgrade elevation. If excavation extends below finished subgrade, use approved material compacted in accordance with Section C to replace undercut material at no additional cost. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material in loose lifts not to exceed 12 inches in depth. Removal and replacement of unstable material will be paid by the Engineer.

B. Earth Cuts. All earth cuts shall be scarified to a uniform depth of at least 6-inches below the required finished subgrade elevation. All holes, ruts, and depressions shall be filled with approved material in loose lifts not to exceed 12 inches in depth. Compact the scarified subgrade in accordance with Section 104.4.C., "Compaction."

If the Engineer determines that the subgrade is unsuitable, the contractor shall remove the unsuitable material to the limits directed by the Engineer and replace it with suitable material. Removal and replacement of unsuitable material will be paid by the Engineer.

C. Compaction. Subgrade materials shall be compacted to the required density and moisture content as shown below, unless otherwise shown on the plans:

Subgrade Material	**Density**	**Moisture Content**
PI ≤ 20	≥ 95% of Max Dry Density	- 2% of Opt. or greater
PI > 20	≥ 95% of Max Dry Density	≥ Opt. Moisture

The maximum dry density and optimum moisture content shall be determined in accordance with TxDOT Test Method Tex-114-E. Tests for in place density shall be made in accordance with TxDOT Test Method Tex-115-E and within 24 hours after compacting operations are completed. If the material fails to meet the density specified, it shall be re-worked as necessary to obtain the density required.

For materials with a PI > 20, just prior to placing any base materials or stabilization, the top 3 inches of compacted subgrade shall be tested for density and moisture content. If tests show the density to be more than 2% below the specified minimum or the moisture content to be more than 3% above or below the optimum, the course shall be reworked as necessary to obtain the specified compaction and moisture content.

If the material used to replace undercuts or unsuitable material contains more than 30% oversize fraction (i.e. 30% or more retained on the ¾-inch sieve) or is gap-graded (many large particles with limited small particles), the maximum density determined by Tex-114-E may not be appropriate for field compaction. If this situation is encountered, the Engineer may elect to accept the material without density testing. With the approval of the Engineer, place layers in loose lifts not to exceed 12 inches. Before and during rolling operations, bring each layer to the moisture content directed. Compact each layer until there is no evidence of further consolidation. Maintain a level layer to aid in uniform compaction. If the required stability or finish is lost for any reason, recompact and refinish the subgrade at no additional expense to the City.

The contractor is also responsible for compaction of trenches installed as a part of this specification.

D. Tolerances. The surface of the subgrade shall be finished to the lines and grades as established. Any deviation in excess of ½-inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding, or removing material, reshaping and compacting by sprinkling and rolling in accordance with Section 104.4.C., "Compaction." Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the work.

E. Quality Control. After each layer of embankment or select material is complete, tests as necessary will be made by the Engineer. If the material fails to meet the density specified, the course shall be reworked, as necessary, to obtain the specified compaction.

Should the subgrade, due to any reason or cause, lose the required stability, density/moisture as described in Section 104.4.C., "Compaction" or finish before the pavement is placed, it shall be recompacted in accordance with Section C and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent layer of asphaltic or other approved material.

104.5. MEASUREMENT: All accepted street excavation will be measured in its original position and the volume computed in cubic yards by the method of average end areas. Cross-sectional areas shall be computed to the established line of the subgrade, to a vertical line behind the curb, as indicated on the plans from the subgrade to the top of the proposed curb and then to the lines for parkway slopes as shown on the cross-sections of the plans.

Excavation and replacement of unsuitable materials below finish subgrade elevations will be measured by the cubic yard with the amount agreed upon by the Contractor and City prior to acceptance.

104.6. PAYMENT: This item will be paid for at the contract unit price bid for "Street Excavation," which price shall be full compensation for all work herein specified, including the furnishing of all materials, equipment, tools, labor, and incidentals necessary to complete the work.

Authorized removal and replacement of unsuitable material in excess of the bid quantity shall be paid for at the unit bid item price for street excavation.

104.7. BID ITEM:

Item 104.1 - Street Excavation - per cubic yard

ITEM

203 TACK COAT

203.1. DESCRIPTION: *Apply asphaltic material on the completed base course after the prime coat has sufficiently cured, existing pavement, bituminous surface, or in the case of a bridge, on the prepared floor slab in accordance with these specifications and/or as directed by the Engineer.*

203.2. MATERIALS: The asphaltic material used for Tack Coat shall meet the requirements for "Asphalt Cement", "Cut-Back Asphalt" or "Emulsified Asphalt" in Item No. 300, "Asphalts, Oils and Emulsions" of the Texas Department of Transportation Standard Specifications. The asphaltic material used for Tack Coat shall be the type or grade shown in the referring specification, or on the plans, or as directed/approved by the Engineer.

203.3. EQUIPMENT: Provide equipment that conforms to the requirements of Item 202, "Prime Coat," Part 3, "Equipment."

203.4. CONSTRUCTION: Before the tack coat is applied, the surface shall be cleaned thoroughly with a vacuum sweeper to the satisfaction of the Engineer. The asphaltic material shall be applied on the clean surface by an approved type of self-propelled pressure distributor evenly and smoothly under a pressure necessary for proper distribution.

The tack coat shall be applied at the rate specified by the referring specification or on the plans. Unless otherwise stated or allowed by the Engineer the application rate shall not exceed 0.10 gallon per square yard of surface.

Where the pavement 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 and all joints shall be painted with a thin uniform coat of the asphaltic material used for tack coat. During the application of tack coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutters or structures.

203.5. MEASUREMENT: The asphaltic material for tack coat will be measured at point of delivery on the project in gallons at the applied temperature. The quantity to be paid for shall be the number of gallons of asphaltic material used, as directed, in the accepted tack coat. Water used with Emulsions will not be measured for payment.

203.6. PAYMENT: The work performed and materials furnished as prescribed by this item will be paid for at the contract unit price bid per gallon for "Tack Coat" which price shall be full compensation for cleaning the surface, for furnishing, heating, hauling and distributing the tack coat as specified; for all freight involved; and for all manipulations, labor, tools, equipment, and incidentals necessary to complete the work.

203.7. BID ITEM:

Item 203.1 - Tack Coat - per gallon

ITEM

208 SALVAGING, HAULING & STOCKPILING RECLAIMABLE ASPHALTIC PAVEMENT

208.1. DESCRIPTION: *Salvage, by milling existing asphalt concrete pavement or asphalt-stabilized base, haul, and stockpile existing asphalt material.*

208.2. EQUIPMENT: The Engineer may require demonstration of the equipment's capabilities.

A. Milling (Planing) Machine. Use milling (planning) machines that:

1. have a minimum 6 foot cutting width except for work areas less than 6 feet wide;

2. are self-propelled with sufficient power, traction, and stability to maintain an accurate depth of cut and slope;

3. can cut in 1 continuous operation:

a. 4 inches of asphalt concrete pavement,

b. 1 inch of concrete pavement,

c. or a combination of 2 inches of asphalt concrete pavement and ½ inch of concrete pavement;

4. use dual longitudinal controls capable of operating on both sides automatically from any longitudinal grade reference, which includes string line, ski, mobile string line, or matching shoe;

5. use transverse controls with an automatic system to control cross slope at a given rate;

6. use integral loading and reclaiming devices to allow cutting, removal, and discharge of the material into a truck in one operation; and

7. include devices to control dust created by the cutting action.

B. Manual System. Use a manual system that can achieve a uniform depth of cut, flush to all inlets, valve covers, manholes, and other appurtenances within the paved area. Use of a manual system is allowed for areas restricted to self-propelled access and for detail pavement removal.

C. Sweeper. Unless otherwise approved, use a street sweeper to remove cuttings and debris from the planed or textured pavement. Equip the sweeper with a water tank, dust control spray assembly, both a pick-up and a gutter broom, and a debris hopper.

208.3. CONSTRUCTION: Remove dirt, raised pavement markings, and other debris, as directed. Unless otherwise shown on the plans, ensure that 95% of the reclaimed material passes a 2 inch sieve. Do not contaminate asphalt material during its removal, transportation, or storage. Repair pavement to remain that is damaged by the removal operations. Work performed under this item shall be prosecuted in such a manner as to cause minimum inconvenience to traffic or to the owners of adjacent property.

A. Grade Reference. When required, place grade reference points at maximum intervals of 50 feet. Use the control points to set the grade reference. Support the grade reference so the maximum deflection does not exceed 1/16 inch between supports.

B. Milling (Planing). Vary the speed of the machine to leave a grid or other pattern type with discontinuous longitudinal reach. Remove the pavement surface for the length, depth, and width shown on the typical section and to the established line and grades. Remove pavement to vertical lines adjacent to curbs, gutters, inlets, manholes, or other obstructions. Do not damage appurtenances or underlying pavement.

Provide a milled (planed) surface that has a uniform textured appearance and riding surface. Surface should be free from gouges, continuous longitudinal grooves, ridges, oil film, and other imperfections of workmanship. Leave a uniform surface of concrete pavement free of asphalt materials when removing an asphalt concrete pavement overlay.

When an overlay on the milled (planed) pavement is not required, provide a minimum texture depth of not less than 0.05 inch. Stop milling (planing) operations when surface texture depth is not sufficient.

When located within 4 inches of steep curbs, water valves, draw grates, bridge joints, etc., asphaltic concrete that cannot be removed by the milling (planing) machine shall be removed by a manual system conforming to 208.2.B. "Manual System" or other methods acceptable to the Engineer.

When milling (planing) over a bridge deck, the milling depth shall not exceed 3/16 inch into the original deck surface of the bridge. Do not damage armor joints, sealed expansion joints, and other appurtenances.

Provide a pavement surface that, after milling (planing), has a smooth riding quality and is true to the established line, grade, and cross section. Provide a pavement surface that does not vary more than ⅛ inch in 10 feet. Evaluate this criterion with a 10 foot straightedge placed parallel to the centerline of the roadway. Deviations will be measured from the top of the texture. Correct any point in the surface not meeting this requirement.

Sweep pavement and gutter. The pavement and curb surfaces shall be cleaned of all debris and left in a neat and presentable condition.

C. Edge Treatments. At the end of the day and for areas under traffic, slope vertical or near vertical longitudinal faces in the pavement surface in accordance with the requirements in the plans. Taper transverse faces to provide an acceptable ride.

D. Salvaged Materials. The loose material resulting from the operation shall become the property of the contractor. If the material is designated to remain the property of the City, it shall be as stockpiled by the Contractor at locations as shown on the plans. Prepare the stockpile site by removing vegetation and trash and by providing proper drainage. Keep salvaged paving material free from contamination during its removal, transportation, and storage. Place different types or quality of salvaged asphalt paving material into separate stockpiles. Silt fencing around stockpile areas shall be provided in accordance with Item 542, "Temporary Sediment Control Fence."

The plans or the Engineer may allow or require the use of salvaged material for other Items in the Contract.

Dispose of unsalvageable material in accordance with applicable federal, state, and local regulations.

208.4. MEASUREMENT: Measurement under this bid item shall include removal of asphaltic concrete pavement by the cubic yard (loose vehicle measurement) of material, or by the square yard in its original position at a depth as shown on the plans.

208.5. PAYMENT: The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard for "Salvaging, Hauling and Stockpiling Reclaimable Asphaltic Pavement" or at the Unit price bid per square yard for "Salvaging, Hauling and Stockpiling Reclaimable Asphaltic Pavement" of the depth specified. This price shall be full compensation for cleaning and removing existing pavement; for any necessary stockpile area preparation; for loading, crushing or breaking, hauling and stockpiling of the material; and for furnishing all materials, labor, tools, equipment, supplies and all incidentals necessary to satisfactorily complete the work.

When plans call for the installation of silt fencing protection around stockpile areas, the fencing will be measured and paid for under Item No. 542.

208.6. BID ITEM:

Item 208.1 - Salvaging, Hauling, and Stockpiling Reclaimable Asphaltic Pavement (___inches depth) - per square yard

Item 208.2 - Salvaging, Hauling, and Stockpiling Reclaimable Asphaltic Pavement - per cubic yard (loose vehicle measurement)

ITEM

230 BASE AND PAVEMENT REPLACEMENT

230.1. DESCRIPTION: *Repair localized sections of flexible pavement and full depth repair of concrete pavement including subgrade, base, and surfacing as shown on the plans due to distress from traffic loading, environment, or other causes. Cutting and replacing existing pavements for utility trench construction (cuts up to 6 feet in width) is specified in Item 511, "Cutting and Replacing Pavements (Trench Repair)."*

230.2. MATERIALS: Furnish materials in accordance with the requirements herein unless otherwise shown on the plans. Provide materials of the type and grade as shown on the plans and in accordance with the pertinent Items listed below:

A. Embankment. Item 107, "Embankment."

B. Lime Treated Subgrade. Item 108, "Lime Treated Subgrade."

C. Cement Treated Subgrade. Item 109, "Cement Treated Subgrade."

D. Flexible Base. Item 200, "Flexible Base."

E. Cement Treated Base. Item 201, "Cement Treated Base."

F. Asphalt Treated Base. Item 206, "Asphalt Treated Base."

G. Prime Coat. Item 202, "Prime Coat."

H. Surface Treatments. Item 204, "Surface Treatments."

I. Hot Mix Asphaltic Concrete Pavement. Item 205, "Hot Mixed Asphaltic Concrete Pavement."

J. Concrete Pavement. Item 209, "Concrete Pavements."

K. Concrete. Item 300, "Concrete."

L. Reinforcing Steel. Item 301, "Reinforcing Steel."

M. Epoxy. TxDOT DMS 6100, "Epoxies and Adhesives."

230.3. EQUIPMENT: Furnish equipment in accordance with the pertinent Items. Use of a motor grader will be permitted for asphalt concrete pavement unless otherwise shown on the plans.

230.4. CONSTRUCTION: Repair using one or more of the following operations as shown on the plans. Cut neat vertical faces around the perimeter of the work area when removing pavement structure layers. Removed materials are the property of the Contractor unless otherwise shown on the plans. Dispose of removed material in accordance with federal, state, and local regulations. Provide a smooth line and grade conforming to the adjacent pavement.

A. Removing Pavement Structure. All concrete and asphaltic concrete pavements shall be cut with a concrete saw or other approved equally capable equipment. If necessary, remove

adjacent soil and vegetation to prevent contamination of the repair area, and place it in a windrow. Do not damage adjacent pavement structure during repair operations.

1. **Existing Flexible Pavement.** The depth of the cut shall be such that upon removal of asphaltic concrete, the sides of the cut will be straight and square. Where existing base materials are to remain, pavements shall be removed to their full depth up to the top of the base material. Care shall be taken not to damage the existing base. If subgrade work is required, remove flexible pavement structure layers from work area.

2. **Existing Concrete Pavement.** Remove areas identified by the Engineer. Make repair areas rectangular, at least 6 feet long and at least ½ a full lane in width unless otherwise shown on the plans. Saw-cut and remove existing asphalt concrete overlay over the repair area and at least 6 inches outside each end of the repair area. Saw-cut full depth through the concrete around the perimeter of the repair area before removal. Do not spall or fracture concrete adjacent to the repair area. Schedule work so that concrete placement follows full-depth saw cutting by no more than 7 days unless otherwise shown on the plans or approved.

   Remove or repair loose or damaged base material, and replace or repair it with approved base material to the original top of base grade. Place a polyethylene sheet at least 4 mils thick as a bond breaker at the interface of the base and new pavement. Allow concrete used as base material to attain sufficient strength to prevent displacement when placing pavement concrete.

B. Preparing Subgrade. Fill holes, ruts, and depressions with approved material. If required, thoroughly wet, reshape, and compact the subgrade as directed.

Where subgrade has failed, remove unstable subgrade material to the depth directed and replace with an approved material.

C. Mixing and Placing Base Material. Place, spread, and compact material in accordance with the applicable Item to the required or directed depth. For flexible pavement repair, when bituminous material is to remain in the pavement structure, pulverize to a maximum dimension of 2-½ inches and uniformly mix with existing base to the depth shown on the plans.

1. **Flexible Base.** Use existing base and add new flexible base as required in accordance with Item 200, "Flexible Base," and details shown on the plans to achieve required section.

2. **Cement-Treated Base.** Use existing base, add flexible base, and stabilize with a minimum cement content of 4% by weight of the total mixture. Construct in accordance with details shown on the plans and Item 201, "Cement Treated Base," to achieve required section.

3. **Asphalt-Treated Base.** Place asphalt-treated base in accordance with details shown on the plans and Item 206, "Asphalt Treated Base," or Item 205, "Hot Mix Asphaltic Concrete Pavement," to achieve required section.

4. **Concrete Base.** Unless otherwise shown on the plans or permitted, furnish pavement concrete for replacement base material when required. The Engineer may waive quality control tests for base material.

D. Curing Base. Cure in accordance with the appropriate Item unless otherwise directed or approved by the Engineer. Maintain completed base sections until surfacing.

E. Surfacing. Apply surfacing with materials as shown on the plans to the completed base section.

1. **Prime Coat.** Protect the compacted, finished, and cured flexible or cement-treated base mixtures with a prime coat of the type and grade shown on the plans. Apply the prime coat at the rate shown on the plans.

2. **Surface Treatments.** Apply surface treatment with the type and grade of asphalt and aggregate as shown on the plans in accordance with Item 204, "Surface Treatments."

3. **Asphalt Concrete Pavement.** Apply tack coat of the type and grade and at the rate shown on the plans unless otherwise directed. Construct in accordance with Item 205, "Hot Mix Asphaltic Concrete Pavement," to achieve required section.

4. **Portland Cement Concrete Pavement.** Use only drilling operations that do not damage the surrounding operations when drilling holes for replacement steel. Place new deformed reinforcing steel bars of the same size and spacing as the bars removed or as shown on the plans. Lap all reinforcing steel splices in accordance with Item 301, "Reinforcing Steel." Place dowel bars and tiebars as shown on the plans. Epoxy-grout all tiebars for at least a 12 inch embedment into existing concrete. Completely fill the tiebar hole with Type III, Class A or Class C epoxy before inserting the tiebar into the hole.

   Provide grout retention disks for all tiebar holes. Provide and place approved supports to firmly hold the new reinforcing steel, tiebars, and dowel bars in place. Demonstrate, through simulated job conditions, that the bond strength of the epoxy-grouted tiebars meets a pullout strength of at least ¾ of the yield strength of the tiebar when tested in accordance with ASTM E 488 within 18 hr. after grouting. Increase embedment depth and retest when necessary to meet testing requirements. Perform tiebar testing before starting repair work.

   If the time frame designated for opening to traffic is less than 72 hours after concrete placement, provide Class HES concrete designed to attain a minimum average flexural strength of 255 psi or a minimum average compressive strength of 1,800 psi within the designated time frame. Otherwise provide Class P concrete conforming to Item 209, "Concrete Pavement." Type III cement is permitted for Class HES concrete. Mix, place, cure, and test concrete to the requirements of Item 209, "Concrete Pavement," and Item 300, "Concrete," unless otherwise shown on the plans. Broom-finish the concrete surface unless otherwise shown on the plans.

   Match the grade and alignment of existing concrete pavement. After concrete strength requirements have been met, replace any asphalt overlay and shoulder material removed with new asphalt concrete material in accordance with Item 205, "Hot Mixed Asphaltic Concrete Pavement."

   For repair areas to be opened to traffic before 72 hours, use curing mats to maintain a minimum concrete surface temperature of 70°F when air temperature is less than 70°F. Cure repaired area for at least 72 hours or until overlaid with asphalt concrete, if required, or until the area is opened to traffic. Saw and seal contraction joints in the repair area in

accordance with Item 209, "Concrete Pavement." Remove repair area debris from the right of way each day.

F. Finishing. Regrade and compact disturbed topsoil. Clean roadway surface after repair operations.

230.5. MEASUREMENT:

A. Flexible Pavement. This Item will be measured by the square yard. In areas where material is excavated, as directed, to depths greater than those specified on the plans, measurement will be made by dividing the actual depth of such area by the plan depth and then multiplying this figure by the area in square yards of work performed. Calculations for each repaired area will be rounded up to the nearest 1/10 square yard. At each repair location, the minimum area for payment purposes will be 1 square yard.

B. Concrete Pavement. This Item will be measured by the square yard of concrete surface area repaired. No measurement will be made for areas damaged because of Contractor negligence.

230.6. PAYMENT:

A. Flexible Pavement. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Flexible Pavement Structure Repair" of the specified depth. This price is full compensation for scarifying, removing, hauling, spreading, disposing of, and stockpiling existing pavement structure; removing objectionable or unstable material; furnishing and placing materials; maintaining completed section before surfacing; applying tack or prime coat; hauling, sprinkling, spreading, and compacting; and equipment, labor, tools, and incidentals.

B. Concrete Pavement. The work performed and the materials furnished in accordance with this Item and measured as specified under "Measurement" will be paid for at the unit price bid for "Concrete Full-Depth Repair" of the type and depth specified. This price is full compensation for removal, stockpiling, and disposal of waste material and for equipment, materials, labor, tools, and incidentals. Asphalt concrete, base material, and curbing will not be paid for directly but will be considered subsidiary to this Item.

230.7. BID ITEM:

Item 230.1 - Flexible Pavement Structure Repair - __inches compacted depth - per square yard

Item 230.2 - Concrete Pavement Full-Depth Repair - __inches compacted depth - per square yard

ITEM

240 WARM MIX ASPHALTIC CONCRETE

240.1. DESCRIPTION: *Construct a pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder mixed in a mixing plant.*

240.2. MATERIALS: Furnish all material(s) meeting the following requirement, unless otherwise shown on the plans or unless otherwise authorized by the Engineer.

A. Tack Coat. Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder and in accordance with Item 203, "Tack Coat." Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

B. Asphalt Binder. Provide the type and grade of performance-graded asphalt binder shown on the plans in accordance with TxDOT Item 300.2.J. "Performance-Graded Binders" prescribed for Hot-Mixed, Hot-Laid Asphalt Mixtures. Provide asphalt binders that are compatible with the materials defined in 240.2. C. "Synthetic, Foaming, Chemical or Other Additives."

C. Synthetic, Foaming, Chemical or Other Additives. Provide an additive that reduces the viscosity of the asphalt binder, allows the binder to fully coat the aggregates, and provides good workability during laying and compaction at temperatures lower than typical hot-mixed asphaltic concrete. Mix or disperse the additive to the asphaltic binder or asphaltic mixture in accordance with the manufacturer's recommendations.

D. Warm Mix Asphalt (WMA). Furnish the types of asphalt concrete materials meeting Item 205, "Hot-Mix Asphaltic Concrete Pavement." The item, type, and grade of aggregate, binder, and state aggregate classification (SAC) and other material requirements will be as shown on the plans when applicable. Unless allowed by the Engineer, different warm mix asphalt technologies (i.e. additives and equipment) may not be used on the same project.

E. EQUIPMENT: Furnish equipment to produce, haul, place, compact, and test the warm mix asphalt concrete in accordance with Item 205.3. "Equipment."

Modify production and placement equipment in the manner required for proper production and placement of the WMA and in conformance with the manufacturer's recommendations.

Maintain all equipment for the handling, mixing, and placing of all materials in good repair and operating condition, as approved. Replace any equipment found defective and affecting the quality of the paving mixture or the compacted pavement.

240.3. CONSTRUCTION: Design, produce, store, transport, place, and compact the warm mix asphalt concrete paving mixture in accordance with the following:

A. General. Transport, place, and compact the specified paving mixture, in accordance with Item 205.4. "Construction" and as approved. Place mixture, when placed with a spreading and finishing machine, or the tack coat when the roadway surface temperature is 60°F or higher unless otherwise approved. Measure the roadway surface temperature with a handheld infrared thermometer. Unless otherwise shown on the plans, place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.

It is further provided that the tack coat or asphaltic mixture shall be placed only when the humidity, general weather conditions, temperature and moisture condition of the base are suitable.

B. Mixture Design and Job Mix Formula. For the WMA paving mixture, the Engineer may accept an HMA mixture design from the Contractor which was derived using materials conforming to the requirements of Item 205. Mixture design shall be conducted in accordance with Tex-204-F, Section 6 – Part IV, "Mix Design for Performance-Designed Mixtures Using the Superpave Gyratory Compactor (SGC)." The number of gyrations (N_{ini}, N_{des}, and N_{max}) and the mixing/compaction temperatures shall be shown on the plans. The laboratory mixture density at N_{des} shall conform to the values shown in Table 5 of Item 205. Evaluate the moisture susceptibility of the WMA paving mixture conforming to the HMA JMF in accordance with TxDOT standard laboratory test procedure Tex-530-C.

C. Tack Coat. The surface upon which the tack coat is to be placed shall be cleaned thoroughly to the satisfaction of the Inspector. The surface shall be given a uniform application of tack coat using asphaltic materials of this specification. Unless otherwise shown on the plans, tack coat shall be applied with an approved sprayer at a rate directed by the Engineer between 0.04 and 0.10 gallon residual asphalt per square yard of surface. The Engineer may use TxDOT standard laboratory test procedure Tex-243-F to verify that the tack coat has adequate adhesive properties. The Engineer may suspend paving operations until there is adequate adhesion. 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 Inspector. All contact surfaces of curbs and structures, as well as all joints, shall have a thin, uniform application of tack coat. During the application of tack coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutter, and other structures.

D. Placement. Place the asphalt concrete mixture in accordance with this specification, the plans, and with Item 205, "Hot Mix Asphaltic Concrete Pavement" or as directed. Limits, areas, and/or locations of the warm mix asphalt pavement must be shown on the plans. Air void control must also be shown on the plans. Furnish the type, size, and number of steel and pneumatic rollers to compact the warm mix asphalt paving mixture as required.

1. **Lift Thicknesses.** Do not exceed compacted lift thicknesses specified in Table 8 in Item 205.4.G, when placing this asphalt concrete mixture unless authorized by the Engineer.

2. **WMA Placement Temperature.** Unless otherwise shown on the plans, the temperature of the warm mix asphalt delivered to the paver shall be in conformance with the manufacturer's recommendations (Manufacturer is defined as the entity that provides the additive defined in 204.2.C. "Synthetic, Foaming, Chemical or Other Additive").

240.4. MEASUREMENT: Warm mix asphalt concrete which includes asphalt, aggregate and the warm mix additive defined in 240.2.C. "Synthetic, Foaming, Chemical or Other Additives" will be measured by the square yard in place.

240.5. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Warm Mix Asphaltic Concrete," of the type, surface, aggregate classification, binder, and additive specified. Costs to modify production or placement equipment for this Item will not be paid by the City.

240.6. BID ITEM:

Item 240.1 - Warm Mix Asphaltic Concrete Type A - per square yard __inches pavement thickness

Item 240.2 - Warm Mix Asphaltic Concrete Type B - per square yard __inches pavement thickness

Item 240.3 - Warm Mix Asphaltic Concrete Type C - per square yard __inches pavement thickness

Item 240.4 - Warm Mix Asphaltic Concrete Type D - per square yard __inches pavement thickness

Item 240.5 - Warm Mix Asphaltic Concrete Type F - per square yard __inches pavement thickness

ITEM

308 DRILLED SHAFTS AND UNDER-REAMED FOUNDATIONS

308.1. DESCRIPTION: *This item shall govern for the construction of foundations consisting of reinforced concrete shafts with or without bell type concrete footings. Concrete shafts shall be placed in drilled excavation when the shafts are without bell type footings and in drilled and under-reamed excavation when shafts are with bell type footings. Such foundations shall be constructed in conformance with the details and governing dimensions shown on the plans.*

TEST HOLE INFORMATION: Logs of test holes dug at the sites are shown in the plans. Test holes have been shown for the purpose of establishing bottom of drilled shaft foundations and determining elevation of ground water, or other soil characteristics, and shall in no way guarantee, either explicit or implied, the actual soil condition encountered at each particular drilled shaft location. The Engineer reserves the right to either lengthen or shorten the depth of drilled shaft shown on the plans, due to actual soil conditions encountered in the field.

308.2. MATERIALS: Provide materials that meet the requirements as shown below:

A. Concrete. All concrete shall conform to the provisions of Item 300, "Concrete."

Unless otherwise shown on the plans, use concrete for drilled shafts that meets the requirements of Table 1.

Table 1
Concrete for Drilled Shafts

Drilled Shaft Type	Concrete
Non-reinforced	Class A
Reinforced	Class C
Slurry and underwater concrete placement	Class SS

Use coarse aggregate Grade 4, 5, or 6 for drilled shaft concrete in reinforced drilled shafts. Grade 2 or 3 may be used if the shaft is dry and reinforcing steel has a 5-in. minimum clear spacing. Use a water-reducing, retarding admixture in accordance with TxDOT DMS-4640, "Chemical Admixtures for Concrete," in all concrete when using casing that will be pulled or when placing shafts underwater or under slurry.

Use concrete with slump that meets the requirements of Table 2 as determined by TxDOT Test Method Tex-415-A.

Table 2
Slump Requirements

Placement Type	Minimum Acceptable Placement Slump, in.	Recommended Design and Placement Slump, in.	Maximum Acceptable Placement Slump, in.
Dry	5½	6½	7½
Under water and under slurry	7	8	9

When casing is to be pulled or when concrete is to be placed underwater or under slurry, perform a slump loss test in accordance with TxDOT Test Method Tex-430-A before beginning work. Provide concrete that will maintain a slump of at least 4 in. throughout the

entire anticipated time of concrete placement. Time of concrete placement is described in Sections 308.3.F, "Concrete," and 308.3.G, "Additional Requirements for Slurry Displacement or Underwater Concrete Placement Methods." Note the temperature of the concrete mix at the beginning of the slump loss test. If concrete temperature at the time of placement into the drilled shaft is more than 10° higher than the slump loss test temperature, do not place the concrete. Use ice or other concrete cooling ingredients to lower concrete temperature, or run additional slump loss tests at the higher temperatures. Slump loss testing will be waived if anticipated time of concrete placement is less than 90 minutes.

B. Slurry for Drilling. Use drilling slurry that meets the requirements of Table 3, as determined by Tex-130-E.

Table 3
Slurry Requirements

Before Introduction into the Excavation		Sampled from the Bottom of the Excavation before Concreting		
Specific Gravity	**Sand Content**	**Specific Gravity**	**Viscosity (seconds)**	**Sand Content**
≤ 1.10	≤ 1%	≤ 1.15	≤ 45	≤ 6%

Use mineral slurry consisting of processed bentonite or attapulgite clays mixed with clean fresh water. Do not use PHPA (partially hydrolyzed polyacrylamide) polymeric slurry or any other fluid composed primarily of a polymer solution.

Before placing concrete, sample slurry from the bottom of the hole, and test it in accordance with Tex-130-E. Use a pump or air lift to remove slurry that does not meet the requirements of Table 3 while adding fresh clean slurry to the top of the hole to maintain the slurry level. Continue this operation until the slurry sampled from the bottom of the hole meets the requirements.

C. Reinforcing Steel. All reinforcing steel shall conform to the provisions of Item 301, "Reinforcing Steel."

D. Welds. All field welds shall conform to Texas Department of Transportation Standard Specification Item 448, "Structural Field Welding."

308.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

308.4. CONSTRUCTION: Place the shaft to within the following tolerances.

- Vertical plumbness - 1 in. per 10 ft. of depth.
- Center of shaft located under column - 1 in. of horizontal plan position.
- Center of shaft located under footing - 3 in. of horizontal plan position.

Complete the embankment at bridge ends before installing drilled shafts that pass through the fill. Refer to Texas Department of Transportation Standard Specification Item 423, "Retaining Walls," for provisions for drilled shafts passing through the structural volume of retaining walls.

A. Excavation. The plans indicate the expected depths and elevations for encountering satisfactory bearing material. Excavate as required for the shafts and bell footings through all materials encountered to the dimensions and elevations shown on the plans or required by the

site conditions. Removal of man-made obstructions not shown on the plans will be paid for in accordance with Item 306, "Structural Excavation."

If satisfactory founding material is not encountered at plan elevation, adjust the bottom of the shaft or alter the foundation, as determined by the Engineer, to satisfactorily comply with design requirements. Blasting is not allowed for excavations.

If caving conditions are encountered, stop drilling and adopt a construction method that stabilizes the shaft walls. Do not excavate a shaft within 2 shaft diameters (clear) of an open shaft excavation, or one in which concrete has been placed in the preceding 24 hours.

Dispose of material excavated from shafts and bells and not incorporated into the finished project. Dispose of excavated material in accordance with the plans and with federal, state, and local laws.

Provide suitable access, lighting, and equipment for proper inspection of the completed excavation and for checking the dimensions and alignment of shafts and bell excavation.

B. Core Holes. If directed, take cores to determine the character of the supporting materials. Use a method that will result in recovery of an intact sample adequate for judging the character of the founding material. Such cores should be at least 5 ft. deeper than the proposed founding grade or a depth equal to the diameter of the shaft, whichever is greater. Take these cores when the excavation is approximately complete.

C. Casing. Use casing when necessary to prevent caving of the material or to exclude ground water. Provide casing with an outside diameter not less than the specified diameter of the shaft. Use casing strong enough to withstand handling stresses and pressures of concrete and of the surrounding earth or water, and that is watertight, smooth, clean, and free of accumulations of hardened concrete.

Drill the portion of the shaft below the casing as close as possible to the specified shaft diameter. The portion of shaft below the casing may be as much as 2 in. smaller than the specified shaft diameter.

Use construction methods that result in a minimal amount of disturbed soil being trapped outside the casing. This does not apply to temporary undersized casings used to protect workers inside shafts or to drilled shafts designed for point bearing only. Do not leave any casing in place unless authorized or shown on the plans.

Do not extract casing until after placing the concrete to an appropriate level. Maintain sufficient concrete in the casing at all times to counteract soil and water pressure. Before and during concrete placement, rotate or move the casing up or down a few inches if necessary to facilitate extraction of the casing.

D. Requirements for Slurry Displacement Method. Unless otherwise shown on the plans, the slurry displacement method may be used to construct drilled shafts. Use this method to support the sides of the excavation with processed mineral slurry that is then displaced by concrete to form a continuous concrete shaft.

Do not use casing other than surface casing. Do not use surface casing longer than 20 ft. without approval. Do not extract the surface casing until after placing the concrete.

For slurry mixed at the project site, pre-mix it in a reservoir of sufficient capacity to fill the excavation and for recovery of the slurry during concrete placement. Do not mix slurry in the shaft excavation or other hole. Allow adequate time for hydration of the slurry prior to introduction into the excavation.

During and after drilling maintain a head of slurry in the shaft excavation at or near ground level or higher as necessary to counteract ground water pressure.

Just before placing reinforcing steel, use an air lift or proper size cleanout bucket to remove any material that may have fallen from the sides of the excavation or accumulated on the bottom after the completion of drilling. Use a cleanout bucket if material is too large to be picked up with an air lift.

If concrete placement is not started within 4 hours of the completion of the shaft excavation, reprocess the hole with the auger as directed. Then clean the bottom with an air lift or cleanout bucket, and check the slurry at the bottom of the hole for compliance with the slurry requirements of Article 416.2, "Materials."

If the slurry forms a gel before concrete placement, agitate the congealed slurry to liquefaction just before concrete placement and whenever directed.

Recover and dispose of all slurry as approved by the Engineer, and in accordance with all federal, state, and local laws. Do not discharge slurry into or in close proximity to streams or other bodies of water.

E. Reinforcing Steel. Completely assemble the cage of reinforcing steel, and place it as a unit immediately before concrete placement. The cage consists of longitudinal bars and lateral reinforcement (spiral reinforcement, lateral ties, or horizontal bands). If overhead obstacles prevent placement of the cage as a single unit, connect individual segments with couplers or by lapping steel as approved.

If the shaft is lengthened beyond plan length, extend the reinforcing steel cage as follows, unless directed otherwise:

- For shafts supporting structures other than bridges, extend the cage to the bottom.
- For bridge shafts with plan lengths of less than 25 ft., extend the cage to 25 ft. or to the bottom, whichever is shorter.
- For bridge shafts with plan lengths at least 25 ft. that are lengthened less than 33% of plan length, extending the cage is not necessary.
- For bridge shafts with plan lengths at least 25 ft. that are lengthened more than 33% of plan length, extend the cage as directed.

If the cage does not reach the bottom of the shaft, it may be suspended, or a portion of the longitudinal steel may be extended to support the cage on the bottom of the shaft. Bars used to extend or support the cage may be lap spliced or welded by a qualified welder. Place the extension at the bottom of the shaft.

If using spiral reinforcement, tie it to the longitudinal bars at a spacing of at most 24 in., or as required for a stable cage. Do not weld lateral reinforcement to longitudinal bars unless otherwise shown on the plans.

Center the reinforcing steel cage in the excavation using approved centering devices. Use enough devices to hold the cage in position along its entire length. Do not use square concrete spacer blocks in cased shafts.

Support or hold down the cage to control vertical displacement during concrete placement or extraction of the casing. Use support that is concentric with the cage to prevent racking and distortion of the steel.

Check the elevation of the top of the steel cage before and after concrete placement or after casing extraction when casing is used. Downward movement of the steel up to 6 in. per 20 ft. of shaft length and upward movement of the steel up to 6 in. total are acceptable.

Maintain the minimum length of steel required for lap with column steel. Use dowel bars if the proper lap length is provided both into the shaft and into the column.

Locate and tie all dowel bars into the cage before placing concrete or insert dowel bars into fresh, workable concrete. Locate and tie anchor bolts when required prior to placement of concrete. Use templates or other devices to assure accurate placement of anchor bolts.

F. Concrete. Perform all work in accordance with requirements of Item 307, "Concrete Structures." Mass concrete placement requirements do not apply to drilled shafts.

Form portions of drilled shaft that project above natural ground.

Remove loose material and accumulated seep water from the bottom of the excavation before placing concrete. If water cannot be removed, place concrete using underwater placement methods.

Place concrete as soon as possible after all excavation is complete and reinforcing steel is placed. Provide workable concrete that does not require vibrating or rodding. Vibrate formed portions of drilled shafts.

Place concrete continuously for the entire length of the shaft. For dry shafts of 24 in. or smaller diameter, limit free fall of concrete to 25 ft. Use a suitable tube or tremie to prevent segregation of materials. Use a tube or tremie in sections to provide proper discharge and to permit raising as the placement progresses. For dry shafts over 24 in. diameter, concrete can be allowed to free fall an unlimited distance if it does not strike the reinforcing cage or sides of the hole during placement. When free fall is used, provide a hopper with a minimum 3-ft.-long drop tube at the top of the shaft to direct concrete vertically down the center of the shaft. Do not use a shovel or other means to simply deflect the concrete discharge from the truck.

For cased shafts, maintain a sufficient head of concrete at all times above the bottom of the casing to overcome hydrostatic pressure. Extract casing at a slow, uniform rate with the pull in line with the axis of the shaft. Monitor the concrete level in the casing during extraction. Stop the extraction and add concrete to the casing as required to ensure a completely full hole upon casing removal. The elapsed time from the mixing of the first concrete placed into the cased portion of the shaft until the completion of extraction of the casing must not exceed the time for which the concrete maintains a slump of over 4 in. in accordance with Article 308.2, "Materials." If the elapsed time is exceeded, modify the concrete mix, the construction procedures, or both for subsequent shafts.

Cure the top surface and treat any construction joint area in accordance with Item 307, "Concrete Structures."

G. Additional Requirements for Slurry Displacement or Underwater Concrete Placement Methods. Place concrete on the same day that the shaft is excavated and as soon as possible after all excavation is complete and reinforcing steel is placed. Use an air lift or cleanout bucket of the proper size to clean the bottom of the excavation prior to placing the reinforcing steel cage and concrete. Place concrete through a closed tremie or pump it to the bottom of the excavation. Initially seal the tremie or pump line to positively separate the concrete from the slurry or water. Place concrete continuously from the beginning of placement until the shaft is completed. If using a tremie, keep it full of concrete and well submerged in the previously placed concrete at all times. Raise the tremie as necessary to maintain the free flow of concrete and the stability of any casing used. If using a pump, keep the discharge tube submerged in the previously placed concrete at all times. Place additional concrete to ensure the removal of any contaminated concrete at the top of the shaft. At the completion of the pour, allow the top portion of concrete to flush completely from the hole until there is no evidence of slurry or water contamination. Do not attempt to remove this concrete with shovels, pumps or other means. Level the top of shaft with hand tools as necessary.

Use a sump or other approved method to channel displaced fluid and concrete away from the shaft excavation. Recover slurry and dispose of it as approved. Do not discharge displaced fluids into or in close proximity to streams or other bodies of water. For pours over water, provide a collar or other means of capturing slurry and the top portion of concrete flushed from the shaft.

If concrete placement is interrupted due to withdrawal of the submerged end of the tremie or pump discharge tube before completion, remove the tube, reseal it at the bottom, penetrate with the tube into the concrete already placed by at least 5 ft., and recharge it before continuing.

The elapsed time from the mixing of the first concrete placed until the completion of concrete placement, including extraction of the casing, must not exceed the time for which the concrete maintains a slump of over 4 in. in accordance with Article 416.2, "Materials." If the elapsed time is exceeded, modify the concrete mix, the construction procedures, or both for subsequent shafts.

H. Test Load. If required, test load shafts in accordance with TxDOT Standard Specification Item 405, "Foundation Test Load."

308.5. MEASUREMENT: Measurement shall be completed as follows:

A. Drilled Shaft. The drilled shaft of the specified diameter, in place in accordance with these specifications, complete and accepted, will be measured by the linear foot of acceptable shaft in place, between the bottom of the footing and the top of the shaft as indicated by the details shown on the plans.

B. Bell Footings. Bell Footings, in place in accordance with these specifications, complete and accepted, will be measured by the cubic yard of concrete. The bell shall be deemed to consist of the footing volume outside of the volume of the drilled shaft which, for purposes of measurement, is considered as extending to the bottom of the bell.

308.6. PAYMENT: Payment for drilled shafts and bell footings shall be at the unit price bid per linear foot for the specified diameter of "Drilled Shafts," and at the unit price bid per cubic yard for "Bell Footings," each measured as specified under "Measurement" and such unit prices shall be full compensation for making all excavations, doing any necessary pumping, placing and removing any required casing, furnishing and placing all-concrete and reinforcing steel, all backfilling, and furnishing all tools, labor, equipment and incidentals necessary to complete the work.

No extra payment will be made for casings left in place.

Where the bottom of the drilled shaft is ordered to be placed at an elevation below plan grade and a splice of reinforcement is required, payment will be made at the unit price bid per pound for Item 301, "Reinforcing Steel" for the extra reinforcement required to make one lap splice per bar of a length determined by the Engineer. The splice required above the top of the drilled shaft shall be considered as included in the unit price bid for drilled shafts.

No partial estimates will be allowed for "Bell Footings" or for "Drilled Shafts" until the concrete has been placed.

308.7. BID ITEM:

Item 308.1 - Drilled Shafts - per linear foot

Item 308.2 - Bell Footing - per cubic yard

DIVISION V - INCIDENTAL CONSTRUCTION

ITEM

500 CONCRETE CURB, GUTTER, AND CONCRETE CURB AND GUTTER

500.1. DESCRIPTION: *Construct hydraulic cement concrete curb, gutter, and combined curb and gutter.*

500.2. MATERIALS: Furnish materials conforming to:

A. Concrete. Item 300, "Concrete." Use Class A concrete or material specified in the plans. Use Grade 8 coarse aggregate for extruded Class A concrete. Use other grades if approved by the Engineer.

B. Reinforcing Steel. Item 301, "Reinforcing Steel."

C. Expansion Joint Materials. Item 304, "Expansion Joint Materials."

D. Membrane Curing Compound. Item 305, "Membrane Curing."

500.3. EQUIPMENT:

A. General. Provide machinery, tools, and equipment necessary for proper execution of the work.

B. Concrete Forms. Forms shall be of metal and shall extend for the full depth of the concrete. Wooden forms may be used, when authorized by the Engineer, on short radius curves such as at street intersections and at such other locations for which curved metal forms may not be available. Wooden forms may be used in other situations when authorized by the Engineer.

All forms shall be free from warp and of sufficient strength to resist the pressure of the concrete without displacement. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal. All forms shall be cleaned and coated with an approved form release agent or form oil before concrete is placed. Divider plates shall be of metal. Forms shall conform to the specified radius when placed on curves.

C. Concrete Curbing Machine. The curb, gutter, or curb and gutter may be constructed by the use of an automatic curb forming machine meeting the following requirements:

1. The weight of the machine shall be such that required compaction is obtained without the machine riding above the bed on which curbing is constructed.

2. The machine shall form curbing that is uniform in texture, shape and density.

3. The forming tube of the extrusion machine or the form of the slipform machine must be easily adjustable vertically during the forward motion of the machine to provide variable heights necessary to conform to the established gradeline.

4. A pointer or gauge shall be attached to the machine so that a continual comparison can be made between the extruded or slipform work and the grade guideline. Other methods may be used when approved by the Engineer.

500.4. CONSTRUCTION: Curbs, gutters, or curb and gutter combinations may be placed using conventionally formed concrete placement or using a City approved self-propelled concrete curbing machine.

Provide finished work with a well-compacted mass and a surface free from voids and honeycomb, in the required shape, line, and grade. Round exposed edges with an edging tool of the radius shown on the plans. Mix, place, and cure concrete in accordance with Item 307, "Concrete Structures." Construct joints at locations shown on the plans. Cure for at least 72 hours unless approved by the Engineer.

Furnish and place reinforcing steel in accordance with Item 301, "Reinforcing Steel."

Set and maintain a guideline that conforms to alignment data shown on the plans, with an outline that conforms to the details shown on the plans.

A. Formed Concrete.

1. **Excavation and Foundation.** Excavate, shape and compact subgrade, foundation, or pavement surface to the line, grade, and cross section shown on the plans. Lightly sprinkle subgrade or foundation material immediately before concrete placement.

   If the subgrade is undercut, or the natural ground is below "top of subgrade," the necessary backfill shall be made with an approved material and compacted with a mechanical tamper. Hand tamping will not be permitted.

2. **Placement.** Place concrete into forms, and strike off with a template ¼ to ⅜ inch less than the dimensions of the finished curb unless otherwise approved. After initial set, plaster surface with mortar consisting of 1 part hydraulic cement and 2 parts fine aggregate. Brush exposed surfaces to a uniform texture.

   Place curbs, gutters, and combined curb and gutters in 50 foot maximum sections unless otherwise approved.

   The reinforcing steel, if required, shall be placed in position as shown on the typical section. Care shall be exercised to keep all steel in its proper location.

   Expansion joint material shall be provided at intervals not to exceed 50 feet, and shall extend the full width and depth of the concrete. Templates for joints shall be of steel, not less than 3/16 of an inch in thickness and patterned to the shape of the curb. Templates shall be cleaned and oiled and spaced to cut the curb in sections 10 feet in length. The templates shall extend a distance of 8 inches into the curb from the top down.

   Two round smooth dowel bars ⅜ of an inch in diameter and 18 inches in length shall be installed at each expansion joint. One 9 inch end of each dowel shall be thoroughly coated with hot oil asphalt so that it will not bond to the concrete; approved types of slip joints may be used in lieu of coating ends of dowels. The dowels shall be placed on the vertical centerline 3 inches from the top and bottom.

Immediately after finishing the curb, it shall be protected by a membrane-compound curing agent.

The curb shall be backfilled to the full height of the concrete, tamped and sloped as directed by the Inspector. The top 4 inches of fill shall be of clean top soil, free of stones and debris.

B. Machine Laid Concrete.

1. **Foundation.** Hand-tamp and sprinkle subgrade or foundation material before concrete placement. Provide clean surfaces for concrete placement. If required, coat cleaned surfaces with approved adhesive or coating at the rate of application shown on the plans or as directed.

2. **Placement.** The concrete shall be fed into the machine in such a manner and at such consistency that the finished curb will present a well compacted mass with a surface free from voids and honeycomb and true to established shape, line and grade.

   Immediately following extrusion any voids between the trench walls and curb shall be filled with well compacted concrete and finished off flush with the surface of the base. Any additional surface finishing specified and/or required shall be performed immediately after the above void-filling operation. Joints shall be cut to a depth of ½ inch at 10 foot intervals or as directed by the Inspector.

   Whenever the curb end abuts a concrete structure a ½ inch, pre-molded, expansion joint, conforming to the curb section, shall be placed between the two concrete surfaces.

   Whenever extrusion is suspended long enough to produce a cold joint, ⅜ inch smooth dowel bars, 18 inches long, shall be embedded 9 inches into the completed curb, one-quarter (¼) curb height from top and bottom. The end of the curb at the point of suspension of extrusion shall be cut back until all remaining concrete is of a dense well compacted nature.

   Any addition of concrete to the extruded curb is to be applied and finished before the extruded curb has achieved its initial set.

   When finishing operations are completed the curb is to be coated with membrane curing compound.

   When the curb has cured, it shall be backfilled to the full height of the concrete, tamped and sloped as directed by the Inspector. The top 4-inches of fill shall be clean top soil, free of stones and debris.

500.5. MEASUREMENT: Accepted work as prescribed by this item will be measured by the linear foot of concrete curb, complete in place.

500.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Curb," "Concrete Curb (Mono)," "Concrete Gutter," or "Concrete Curb and Gutter" of the type specified. This price is full compensation for surface preparation of base, equipment, labor, materials, tools, and incidentals. Topsoil to be paid under Item 515, "Topsoil."

500.7. BID ITEM:

Item 500.1 - Concrete Curb - per linear foot

Item 500.2 - Concrete Curb (Mono) - per linear foot

Item 500.3 - Concrete Gutter - per linear foot

Item 500.4 - Concrete Curb and Gutter - per linear foot

ITEM

526 FIELD OFFICE

526.1. DESCRIPTION: *This item shall govern the erection or furnishing of a building to be used by the inspection force as a Field Office where the contract amount is one million dollars or greater.*

526.2. EQUIPMENT:

A. General. Furnish facilities after the receipt of the work order to begin work and before beginning physical work on the project. Provide field offices of the type and number specified near the worksite at a location acceptable to the Engineer. The Contractor may make use of permanent buildings or rental space meeting the requirements for field offices instead of portable buildings if approved. Maintain the field office until the City accepts the project. Furnish other equipment as required.

B. Damage. Immediately repair or replace the facility if it is damaged in any manner. Payment for repair will not be made unless it is the result of negligence by the City. Reimburse the City for equipment damaged by the Contractor's operations.

C. Right-Of-Way. When facilities are allowed in the right of way, remove buildings and other facilities and restore the right of way before project acceptance.

D. Parking and Fencing. Unless otherwise shown on the plans, provide an all-weather parking area for the sole use of at least 2 City-owned vehicles. Situate the area near the field office or laboratory at a location acceptable to the Engineer. Maintain the parking area until the project is completed and restore the area to a condition acceptable to the Engineer upon project completion. When shown on the plans, enclose the field office or laboratory and the parking area with a 6-ft. chain-link fence, a top-mounted 3-strand barbed wire, and a 12-ft. gate.

E. Buildings.

1. Field Office. Provide field offices with roofs, floors, doors, and screened windows. The building shall be a minimum of 10 feet by 16 feet by 8 feet high with not less than three glass windows and one door. Ensure the floor is of sufficient strength to support testing equipment and has an impervious floor covering.

If the Contractor uses part of the structure, do not interconnect the field office with Contractor-used rooms.

Ensure that the field office is weatherproof, piped for water and fuel, and electrically wired by certified personnel with the power requirements shown on the plans or directed by the Engineer. Furnish and install adequate equipment, outlets, lighting, air conditioning, heating, and ventilation.

Provide a partitioned rest room furnished with rest room supplies, a lavatory and a flush toilet connected to a sewer or septic tank. A portable toilet may be used when approved by the Engineer.

When directed by the Engineer, provide secured and controlled access to the field office or laboratory through the use of security measures such as bars, alarms, or security fencing. Furnish steps to the building if deemed necessary by the Engineer.

2. **Laboratory.** Provide laboratories with all of the requirements described in Section 526.2.E.1, "Field Office." In addition, provide the following items unless otherwise directed:

   a. laboratory equipment necessary for testing when shown on the plans;

   b. water (for testing purposes) from an approved source;

   c. an exhaust fan for concrete curing, asphalt, or other operations to meet OSHA requirements (Vent all exhaust to the outside of the structure.);

   d. a work platform at least 18 in. long and 12 in. wide, mounted on a lumber post at least 6 in. by 6 in. extending through the floor and firmly fixed in the ground (The work platform support can be provided by other methods as shown on the plans or as directed.);

   e. a minimum of 20 ft. of total work counter length at least 3 ft. wide and 3 ft. above the floor and of sufficient strength to support required testing equipment;

   f. and a laboratory sink measuring 24 in. by 30 in. and 12 in. in depth.

F. Field Office and Laboratory Appurtenances. Provide workbenches and tables at least 3 ft. wide and 6 ft. long, chairs, and filing cabinets in the quantity acceptable to the Engineer. Provide solar screens, blinds, or shades if deemed necessary by the Engineer. Provide potable water, electricity, collection and disposal of trash, and janitorial services acceptable to the Engineer.

Provide a telephone and service unless otherwise directed. A cell phone may be provided to meet this requirement. Provide a paper copier and facsimile when required by the plans.

For Contracts that require a nuclear gauge for moisture or density determination, provide a closet within the facility or a separate structure for storage of the gauge as far as possible from the normal office work. For all doors allowing access to the nuclear gauge, provide internal keyed deadbolt locks and hinges with pins on the inside of the storage area.

When shown on the plans provide any or all of the following in accordance with the requirements therein:

- computers (laptop or desktop) meeting the minimum requirements of Item 1000, "Web Portal" or as designated on the plans,
- printers, and
- Internet service. The Internet service must be a provided on a line separate from required phone service.

526.3. MEASUREMENT: No measurement will be made under this item.

526.4. PAYMENT: No payment will be made under this item. The Field Office is not a pay item and shall remain the property of the contractor after completion of this project.

526.5. BID ITEM:

N/A

ITEM

530 BARRICADES, SIGNS, AND TRAFFIC HANDLING

530.1. DESCRIPTION: *This item shall govern for providing, installing, moving, repairing, maintaining, cleaning and removing upon completion of work, all barricades, signs, cones, lights and other such type devices and of handling traffic as indicated on the plans or as directed by the Engineer.*

530.2. GUIDELINES FOR BARRICADING ON CITY RIGHT-OF-WAY: The barricade contractor must locally maintain sufficient materials in stock to accommodate three or more construction phases per project. These will include all applicable traffic control sign types, trucks, trailers, arrow boards, and all other traffic control devices assigned to the Contractor's barricading operation.

The *Texas Manual on Uniform Traffic Control Devices (TMUTCD)*, Section 6A-6, requires the appropriate training for all personnel who are involved in the selection, placement, and maintenance of traffic control devices on construction projects. The City of San Antonio requires that all personnel associated with barricading operations and traffic handling possess certificates from either of the two groups listed in Table 1 below. Each certificate will be valid for four years.

Table 1
Barricading Training

Texas Engineering Extension Service	American Traffic Safety Service Association
Work Zone Traffic Control	Training Course for Worksite Traffic Supervisors

The Contractor shall have a minimum of one barricade supervisor and three persons who are responsible for construction work zone traffic control. These persons shall be based in the San Antonio metropolitan area and their sole tasks shall be implementing and maintaining construction work zone traffic control devices.

The Contractor shall have a commercial telephone answering service during non-working hours. The Contractor shall provide the City during working hours with an office telephone number, pager number, and cellular telephone number to contact the barricading supervisor. The contractor must be able to respond to any call within two hours. The barricading contractor or General Contractor must possess liability insurance in the minimum amount of one million dollars. A copy of the liability policy must be sent to the City Traffic Engineer for approval 48 hours prior to starting barricading operations.

The contractor shall comply with all standards set forth in the plan barricade detail sheets. One noncompliance letter issued by the City to the Contractor in regard to construction work zone traffic control, and not corrected within 48 hours, will be cause for delay of payment for this item.

If the general contractor elects to do his own barricading, he must comply with all the foregoing requirements. Additionally, a general contractor will be required to submit a traffic control plan (TCP) at least 72 hours in advance (excluding weekends and holidays) of starting work in each construction phase. Upon satisfactory evidence of competent barricading expertise, this requirement for a traffic control plan may be waived by the City Traffic Engineer.

530.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

530.4. CONSTRUCTION: All barricades, signs, and other types of devices listed above shall conform to the requirements of the TMUTCD. It is the contractor's responsibility to see that all traffic control devices are properly installed and maintained at the job site. If it is determined by the Traffic Engineering Representative that the traffic control devices do not conform to the established standards, or are incorrectly placed to protect the general public, the Traffic Engineer shall have the option to stop the work, at no expense to the City, until the situation is corrected by the Contractor. If it is determined that additional temporary traffic control devices, special directional devices, and/or business name signs are required, they will be provided by the contractor at no additional cost. As work progresses, the location of temporary traffic control devices will be adjusted and modified as necessary by the Contractor.

All retro reflective traffic control devices such as barricades, vertical panels, signs, etc., shall be maintained by cleaning, replacing or a combination thereof such that during darkness and rain, the retro reflective characteristics shall equal or exceed the retro reflective characteristics of the standard reflective panels in the Inspector's possession.

The contractor shall contact the City of San Antonio Traffic Operations Section prior to removing any traffic signs or traffic signals. Prior to completion of the contract and removal of barricades, all applicable permanent traffic signs and signals must be in place and functioning properly. All permanent signs or traffic control devices missing or damaged during construction shall be replaced at the contractor's expense. Permanent pavement marking shall be applied prior to the opening of any street to traffic. Temporary short-term expendable pavement markings may be provided prior to application of permanent markings.

The contractor must maintain all streets open to through traffic by repairing trenches, potholes, etc., at no direct payment. The contractor shall provide reasonable access to residences and all businesses within all phases of the work, as well as providing suitable access accommodations for school children, pedestrians, garbage pick-up and mail delivery by the US Postal Service. Temporary pedestrian crossing will be determined in the field by the Police Department School Services Unit. Temporary pedestrian crossings shall be 4 feet wide by 4 inches thick asphalt treated base or asphaltic concrete and will be paid for under Item 206, "Asphalt Treated Base" or Item 205, "Hot Mix Asphaltic Concrete Pavement," respectively.

When flagging is required by the plans or Traffic Control Plan, provide a Contractor representative who has been certified as a flagging instructor through courses offered by the Texas Engineering Extension Service, the American Traffic Safety Services Association, the National Safety Council, or other approved organizations. Provide the certificate indicating course completion when requested. This representative is responsible for training and assuring that all flaggers are qualified to perform flagging duties. A qualified flagger must be independently certified by one of the organizations listed above or trained by the Contractor's certified flagging instructor. Provide the Engineer with a current list of qualified flaggers before beginning flagging activities. Use only flaggers on the qualified list.

Flaggers must be courteous and able to effectively communicate with the public. When directing traffic, flaggers must use standard attire, flags, signs, and signals and follow the flagging procedures set forth in the TMUTCD.

530.5. MEASUREMENT: This item will be measured by "Lump Sum" as indicated on the plans.

530.6. PAYMENT: This item will be paid for at the contract lump sum price bid for "barricades, signs, and traffic handling". This price shall be full compensation for furnishing all labor, materials, supplies, equipment and incidentals necessary. To complete the work as specified. The lump sump price will be pro-rated based on the number of workdays in the project contract. Failure to complete the work within time allowed in the project contract due to approving designs, testing, material shortages, closed construction season, curing periods, and testing periods will not qualify for additional compensation. When additional work is added by an approved field alteration or when work is suspended for the convenience of the City, through no fault of the contractor, additional compensation may be paid to the Contractors.

530.7. BID ITEM:

Item 530.1 - Barricades, Signs and Traffic Handling - lump sum

ITEM

535 HOT APPLIED THERMOPLASTIC PAVEMENT MARKINGS

535.1. DESCRIPTION: *Apply thermoplastic pavement markings, in conformance with the minimum optical and physical properties required for a thermoplastic road marking compound described herein, in a molten state, onto a pavement surface.*

535.2. MATERIALS: All materials shall conform to the requirements of TxDOT DMS-8220 "Hot Applied Thermoplastic." Thermoplastic materials shall be stored in a dry environment to minimize the amount of moisture retained during storage.

535.3. EQUIPMENT: Provide the necessary equipment to conduct the work specified herein. All equipment shall be maintained in good working order such that neat and clean thermoplastic markings are applied at the proper thicknesses and glass beads are placed at the correct rate. Equipment that is deemed deficient by the Engineer shall be replaced immediately.

535.4. CONSTRUCTION: The appearance of the finished markings shall have a uniform surface, crisp edges with a minimum over-spray, clean cut-off, meet straightness requirements and conform to the design drawings and/or engineer instructions.

The contractor shall provide the Engineer with certification from the marking manufacturer that contractor has been adequately trained and certified to apply the manufacturer's material. This certification shall be considered current if the certification date provided by the manufacturer is within two years of the date of marking application.

All striping and pavement markings shall be placed in accordance with the requirements of this specification, the detailed plans, and the current edition of the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD). The Contractor shall provide all other engineering services necessary for pre-marking of all proposed stripe within the limits of the designated work.

Unless authorized otherwise in writing by the Engineer, striping shall be accomplished during daylight hours. Approved lighting arrangements will be required for night time operations when allowed.

The Contractor may be required to place markings over existing markings, as determined by the Engineer. The contractor shall adjust the operation of the thermoplastic screed shoe to match the previous lengths of stripes and skips, when necessary.

Failure of the striping material to adhere to the pavement surface during the life of the contract shall be prima facie evidence that the materials, even though complying with these specifications, or the application thereof, was inconsistent with the intent of the requirements for the work under the latest City specifications and shall be cause for ordering corrective action or replacement of the marking without additional cost to the City.

Unless otherwise approved by the Engineer, permanent pavement markings on newly constructed pavements surfaced with asphaltic concrete or bituminous seals shall not be applied for a minimum of 14 days or a maximum 35 days. Temporary pavement marking shall be provided during the 14 to 35 day period.

A. Surface Preparation.

1. **Moisture.** All surfaces shall be inspected for moisture content prior to application of thermoplastic. Approximately two square feet of a clear plastic or tar paper shall be laid on the road surface and held in place for 15 to 20 minutes. The underside of the plastic or tar paper shall then be inspected for a buildup of condensed moisture from the road surface. Pavement is considered dry if there is no condensation on the underside of the plastic or tarpaper. In the event of moisture, this test shall be repeated until there is no moisture on the underside of the plastic or tar paper.

2. **Cleaning.** All surfaces shall be clean and dry, as defined in Section 535.4.A.1, before thermoplastic can be applied. Loose dirt and debris shall be removed by thoroughly blowing compressed air over the area to be striped. If the thermoplastic is to be applied over existing paint lines, the paint line shall be swept with a mechanical sweeper or wire brush to remove poorly adhered paint and dirt that would interfere with the proper bonding or the thermoplastic. Additional cleaning through the use of compressed air may be required to remove embedded dirt and debris after sweeping. Latence and curing compound shall be removed from all new portland cement concrete surfaces in accordance with Item 533, "Removal of Pavement Markings and Markers."

3. **Layout.** The pavement markings shall be placed in proper alignment with guidelines established on the roadway. Deviation from the alignment established shall not exceed 2 inches and, in addition, the deviation in alignment of the marking being placed shall not exceed 1 inch per 200 feet of roadway nor shall any deviation be abrupt.

   No striping material shall be applied over a guide cord; only longitudinal joints, existing stripes, primer, or other approved type guides will be permitted. In the absence of a longitudinal joint or existing stripe, the Contractor shall mark the points necessary for the placing of the proposed stripe. Edge striping shall be adjusted as necessary so that the edge stripe will be parallel to the centerline and shall not be placed off the edge of the pavement.

   Longitudinal markings shall be offset at least 2-inches from construction joints of portland cement concrete surfaces and joints and shoulder breaks of asphalt surfaces.

4. **Primer Sealer.** Primer sealer shall be used on all portland cement concrete surfaces. A primer sealer shall be used on asphalt surfaces that are over two years old and/or on asphalt surfaces that are worn or oxidized to a condition where 50 percent or more of the wearing surface is exposed aggregate. Existing pavement markings may act as the primer sealer if, after cleaning, more than 70 percent of the existing pavement marking is still properly bonded to the asphalt surface (see coverage check procedure in Appendix A to estimate percent of marking remaining).

5. **Primer Sealer Application.** When required as described, the primer-sealer shall be applied to the road surface in a continuous film at a minimum thickness of 3 to 5 mils. Before the Thermoplastic is applied, the primer-sealer shall be allowed to dry to a tacky state. The thermoplastic shall be applied within 4 hours after the primer application.

B. Temperature Requirements.

1. **Ambient Conditions.** The ambient air and road surface shall be 55ºF and rising before application of thermoplastic can begin.

2. **Material Requirements.** Unless otherwise specified by the material manufacturer, the thermoplastic compound shall be heated from 400ºF to 450ºF and shall be a minimum of 400ºF as it makes contact with road surface during application. An infrared temperature gun shall be used to determine the temperature of the thermoplastic as it is being applied to the road surface.

C. Drop-on Glass Sphere Application.

1. **Application Rate.** Retro-reflective glass spheres shall be applied at the rate of 10 pounds per 100 square feet of applied markings. This application rate shall be determined by confirming the following consumption rates:

   a. 200 pounds of drop on glass spheres per ton of applied thermoplastic when the thermoplastic is being applied at 0.090 inch film thickness.

   b. 150 pounds of drop on glass spheres per ton of applied thermoplastic when the thermoplastic is being applied at 0.125 inch thickness.

2. **Application Method.** Retro-reflective glass spheres shall be applied by a mechanical dispenser property calibrated and adjusted to provide proper application rates and uniform distribution of the spheres across the cross section of the entire width of the line. To enable the spheres to embed themselves into the hot thermoplastic, the sphere dispenser shall be positioned immediately behind the thermoplastic application device. This insures that the spheres are applied to the thermoplastic material while it is still in the molten state.

D. Application Thickness.

1. **Longitudinal and Transverse Markings.** On previously unmarked pavements or pavements where markings have been effectively removed, all lane lines, center lines, transverse markings and pavement markings in traffic areas with ≤1,000 vehicles per day per lane shall have a minimum film thickness of 0.090 inch at the edges and a maximum of 0.145 inch at the center. A minimum average film thickness of 0.090 inch shall be maintained. On pavements with existing markings, meeting the traffic requirements stated above, all lane lines, center lines, transverse markings and pavement markings shall have a minimum film thickness of 0.060 inch for re-application over existing strip line.

2. **High Wear Longitudinal and Transverse Marking.** On previously unmarked pavements or pavements where markings have been effectively removed, all lane lines, center lines, transverse markings and pavement markings in high traffic areas (>1,000 vehicles per day per lane) shall have a minimum film thickness of 0.125 inch at the edges and a maximum of 0.188 inch at the center. A minimum average film thickness of 0.125 inch shall be maintained. On pavements with existing markings, meeting the traffic requirements stated above, all lane lines, center lines, transverse markings and pavement markings shall have a minimum film thickness of 0.090 inch for re-application over existing strip line.

E. Packaging.

1. **Containers.** The thermoplastic material shall be delivered in 50 pound containers or bags of sufficient strength to permit normal handling during shipment and handling on the job without loss of material.

2. **Labeling.** Each container shall be clearly marked to indicate the color of the material, the process batch number and/or manufacturer's formulation number, the manufacturer's name and address and the date of manufacture.

F. Acceptance.

1. **Sampling Procedure.** Random samples may be taken at the job site at the discretion of the City Engineer for quality assurance. The City reserves the right to conduct the tests deemed necessary to identify component materials and verify results of specific tests indicated in conjunction with the specification requirements.

   The sample(s) shall be labeled as to the shipment number, lot number, date, quantity, and any other pertinent information. At least three randomly selected bags shall be obtained from each lot. A 10 pound) sample from the three bags shall be submitted for testing and acceptance. The lot size shall be approximately 44,000 pounds unless the total order is less than this amount.

2. **Manufacturer's Responsibility.**

   a. **Sampling and Testing.** The manufacturer shall submit test results from an approved independent laboratory. All material samples shall be obtained 20 days in advance of the pavement marking operations. The cost of testing shall be included in the price of thermoplastic material. The approved independent laboratory's test results shall be submitted to the City Traffic Engineer in the form of a certified test report.

   b. **Bill of Lading.** The manufacturer shall furnish the Material and Tests Laboratory with copies of Bills of Lading for all materials inspected. Bill of lading shall indicate the consignee and the destination, date of shipment, lot numbers, quantity, type of material, and location of source.

   c. **Material Acceptance.** Final acceptance of a particular lot of thermoplastic will be based on the following.

      (1) Compliance with the specification for material composition requirements verified by approved independent laboratory with tests results.

      (2) Compliance with the specification for the physical properties required and verified by an approved independent laboratory with test results.

      (3) Manufacturer's test results for each lot thermoplastic have been received.

      (4) Identification requirements are satisfactory.

3. **Contractor's Responsibility.**

   a. **Notification.** The contractor shall notify the Construction Inspector 72 hours prior to the placement of the thermoplastic markings to enable the inspector to be present during the application operation. At the time of notification, the Contractor shall indicate the manufacturer and the lot numbers of the thermoplastic that will be used.

A check should be made by the contractor to insure that the approved lot numbers appear on the material package. Failure to do so is cause for rejection.

b. Warranty or Guarantee. If the normal trade practice for manufacturers is to furnish warranties or guarantees for the materials and equipment specified herein, the Contractor shall turn the guarantees and warranties over to the Engineer for potential dealing with the manufactures. The extent of such warranties or guarantees will not be a factor in selecting the successful bidder.

535.5. MEASUREMENT: Measurement shall be based on the length of satisfactorily installed line, in feet, or as appropriate, the number of symbols or words which are satisfactorily installed on the roadway surface by the contractor.

535.6. PAYMENT: Payment shall be according to the quantities measured for each bid item.

535.7. BID ITEM:

Item 535.1 - 4 inch wide yellow line

Item 535.2 - 4 inch wide white line

Item 535.3 - 8 inch wide yellow line

Item 535.4 - 8 inch wide white line

Item 535.5 - 12 inch wide white line

Item 535.6 - 16 inch wide white line

Item 535.7 - 24 inch wide white line

Item 535.8 - Right White Arrow (per each)

Item 535.9 - Left White Arrow (per each)

Item 535.10 - Combination Thru/Right White Arrow (per each)

Item 535.11 - Combination Thru/Left White Arrow (per each)

Item 535.12 - Word “ONLY” (per word)

Item 535.13 - Straight White Arrow (per each)

Item 535.14 - Railroad Crossing Symbol, including two R's, crossbuck and 3 transverse bars (per each)

Item 535.15 - White Diamond (per each)

Item 535.16 - Straight White Arrow Bicycle Facility (per each)

Item 535.17 - Bicycle Rider Symbol (per each)

Item 535.18 - Solid White Yield Lines (6” x 9”) (per each)

Item 535.19 - Word “STOP” (per word)

Item 535.20 - Word “YIELD” (per word)

Item 535.21 - Word “BUS) (per word)

ITEM

537 RAISED PAVEMENT MARKERS

537.1. DESCRIPTION: *Provide raised pavement markers which include reflectorized and non-reflectorized traffic buttons, pavement markers and jiggle bars all of which are capable of being attached to a roadway surface by an adhesive.*

537.2. MATERIALS: Materials shall conform to the following requirements:

A. Jiggle Bar Tiles. TxDOT DMS-4100, "Jiggle Bar Tiles."

B. Raised Pavement Markers. TxDOT DMS-4200, "Pavement Markers (Reflectorized)."

C. Traffic Buttons. TxDOT DMS-4300, "Traffic Buttons."

D. Testing. The Engineer reserves the right to perform any or all tests required by this item as a check on the tests reported by the manufacturer. Upon request, the Contractor shall furnish, free of charge, samples of the material of the size and in the amount determined by the Engineer for test purposes. In case of any variance, the Engineer's tests will govern.

537.3. EQUIPMENT: Provide all equipment necessary to perform the work specified herein.

537.4. CONSTRUCTION: The Contractor shall establish guides to mark the lateral location of pavement markings as shown on the plans or as directed by the Engineer. The Engineer shall approve locations of these markings and may authorize necessary adjustments from the plans.

The reflective faces of all Type II markers shall be positioned so that the direction of reflection of one (1) face shall be directly opposite to the direction of reflection of the other face.

Raised Pavement markers Type I-C shall have clear reflector face towards traffic. Raised pavement markers Type II C-R, shall have the clear face toward the normal traffic flow and the red face toward wrong-way traffic.

Unless otherwise shown on the plans or specified by the Engineer, all raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes. The first and last raised pavement marker in a no-passing line shall be a reflective marker. Buttons used to simulate a 10 feet skip lane lines shall be spaced at 40 inches.

The pavement markers not placed in accordance with the plans or as directed by the Engineer shall be removed by the Contractor at the Contractor's expense.

Removal of existing pavement markers or residual adhesive from a missing pavement marker prior to placement of new or replacement marker(s) shall be in conformance with Item 533, "Cleaning or Removal of Pavement Markings or Markers." The portion of the highway surface to which the raised pavement marker is attached by the adhesive shall be clean and free of dirt, grease, oil, and moisture at the time of installation. Surface preparation for installation of raised pavement markers will not be paid for directly, but shall be considered subsidiary to this item. Unsound pavement or other materials that would adversely affect the bond of the adhesive shall not be an acceptable surface.

The hot epoxy adhesive shall be applied so that 100 percent of the bonding area of the raised pavement marker will be in contact and shall be of sufficient thickness so that excess adhesive shall be forced out around the perimeter of the raised pavement marker but without impairing the functional capability of the reflectivity of the pavement marker. When the project is complete, the raised pavement marker shall be firmly bonded to the pavement; lines formed by the raised pavement markers shall be true, and the entire installation shall present a neat appearance.

Where required by the Engineer, pavement markings outside the limits of this project will be removed or adjusted to provide for a proper tie into this project. The old markings shall be removed or defaced in such a manner that they do not give the appearance of traffic pavement markings.

537.5. MEASUREMENT: Measurement will be based on the number of satisfactorily installed pavement markers.

537.6. PAYMENT: Pavement markers will be paid for at the contract unit bid price per each type of marker. The price shall be full compensation for furnishing the raised pavement marker, epoxy adhesive and all other materials, surface preparation, installation, labor, equipment, tools and incidentals necessary to complete the work.

537.7. BID ITEM:

Item 537.1 - Traffic Button (Type W) per each

Item 537.2 - Traffic Button (Type Y) per each

Item 537.3 - Jiggle Bar (Type W) per each

Item 537.4 - Jiggle Bar (Type Y) per each

Item 537.5 - Pavement Marker (Type I-A) per each

Item 537.6 - Pavement Marker (Type I-C) per each

Item 537.7 - Pavement Marker (Type I-R) per each

Item 537.8 - Pavement Marker (Type II-A-A) per each

Item 537.9 - Pavement Marker (Type II C-R) per each

ITEM

540 TEMPORARY EROSION, SEDIMENTATION AND WATER POLLUTION PREVENTION AND CONTROL

540.1. DESCRIPTION: *This item shall govern the control measures necessary to prevent and control soil erosion, sedimentation and water pollution which may degrade receiving waters including rivers, streams, lakes, reservoirs, tidal water, groundwater and wetlands.*

Note: The control measures contained herein shall be installed and maintained throughout the construction contract and coordinated with the permanent or existing temporary pollution control features specified elsewhere on the plans and in the specifications to assure effective and continuous water pollution control throughout the construction and post construction period. These control measures shall not be used as a substitute for the permanent pollution control measures unless otherwise directed by the Engineer in writing. The controls may include sediment control fences, inlet protection, baled hay, rock filter dams, dikes, swales, sediment traps and basins, pipe slope drains, paved flumes, construction exits, temporary seeding, sodding, mulching, soil retention blankets or other structural or non-structural water pollution controls. This item does not apply to commercial operations.

540.2. MATERIALS: The items, estimated quantities and locations of the control measures are shown on the plans; however, the Engineer may increase or decrease the quantity of these items as the need arises. The materials will be shown on the plans and in this specification. The Engineer may allow other materials and work as the need arises and as approved in writing. Pollution control measures may be applicable to contractor operations outside the right of way where such work is necessary as a result of roadway related construction such as construction and haul roads, field offices, equipment and supply areas, and materials sources.

Unless otherwise shown on the plans, provide materials that meet the following requirements:

A. Rock Filter Dams.

1. **Aggregate.** Furnish aggregate with hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding acceptable to the Engineer. Provide the following:

   - **Types 1, 2, and 4 Rock Filter Dams.** Use 3 to 6 in. aggregate.

   - **Type 3 Rock Filter Dams.** Use 4 to 8 in. aggregate.

2. **Wire.** Provide minimum 20 gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:

   - a double-twisted, hexagonal weave with a nominal mesh opening of 2½ in. x 3¼ in.;
   - minimum 0.0866 in. steel wire for netting;
   - minimum 0.1063 in. steel wire for selvages and corners; and
   - minimum 0.0866 in. for binding or tie wire.

3. **Sandbag Material.** Furnish sandbags meeting Section 540.2.I, "Sandbags," except that any gradation of aggregate may be used to fill the sandbags.

B. Temporary Pipe Slope Drains. Provide corrugated metal pipe, polyvinyl chloride (PVC) pipe, flexible tubing, watertight connection bands, grommet materials, prefabricated fittings, and flared entrance sections that conform to the plans. Recycled and other materials meeting these requirements are allowed if approved. Furnish concrete in accordance with Item 505, "Concrete Riprap."

C. Baled Hay. Provide hay bales weighing at least 50 lb., composed entirely of vegetable matter, measuring 30 in. or longer, and bound with wire, nylon, or polypropylene string.

D. Temporary Paved Flumes. Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material that conforms to the plans. Provide rock or rubble with a minimum diameter of 6 in. and a maximum volume of ½ cu. ft. for the construction of energy dissipaters.

E. Construction Exits. Provide materials that meet the details shown on the plans and this Section.

1. **Rock Construction Exit.** Provide crushed aggregate for long and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft, or flaky materials and organic and injurious matter. Use 4- to 8- in. rock for Type 1 and 2- to 4- in. rock for Type 3. Unless otherwise shown on the plans, provide a light weight (4 oz.) non-woven filter fabric below the ballast to prevent mud and sediment migration.

2. **Timber Construction Exit.** Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers with nuts and bolts or lag bolts, of at least ½ in. diameter, unless otherwise shown on the plans or allowed. For short-term exits, provide plywood or pressed wafer board at least ½ in. thick.

3. **Foundation Course.** Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the plans or directed.

F. Embankment for Erosion Control. Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.

G. Pipe. Provide pipe outlet material in accordance with TxDOT Standard Specification Item 556, "Pipe Underdrains," and details shown on the plans.

H. Construction Perimeter Fence.

1. **Posts.** Provide essentially straight wood or steel posts that are at least 60 in. long. Furnish soft wood posts with a minimum diameter of 3 in. or use 2 x 4 boards. Furnish hardwood posts with a minimum cross-section of 1½ x 1-1/5 in. Furnish T- or L-shaped steel posts with a minimum weight of 0.95 lb. per foot.

2. **Fence.** Provide orange construction fencing as approved by the Engineer.

3. **Fence Wire.** Provide 14 gauge or larger galvanized smooth or twisted wire. Provide16 gauge or larger tie wire.

4. **Flagging.** Provide brightly-colored flagging that is fade-resistant and at least ¾ in. wide to provide maximum visibility both day and night.

5. **Staples.** Provide staples with a crown at least ½ in. wide and legs at least ½ in. long.

6. **Used Materials.** Previously used materials meeting the applicable requirements may be used if accepted by the Engineer.

I. Sandbags. Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 oz. per square yard, a Mullen burst-strength exceeding 300 psi, and an ultraviolet stability exceeding 70%. Use natural coarse sand or manufactured sand meeting the gradation given in Table 1 to fill sandbags. Filled sandbags must be 24 to 30 in. long, 16 to 18 in. wide, and 6 to 8 in. thick.

Table 1
Sand Gradation

Sieve #	Maximum Retained (% by Weight)
4	3%
100	80%
200	95%

J. Temporary Sediment Control Fence. Provide a net-reinforced fence using woven geo-textile fabric. Logos visible to the traveling public will not be allowed.

1. **Fabric.** Provide fabric materials in accordance with TxDOT DMS-6230, "Temporary Sediment Control Fence Fabric."

2. **Posts.** Provide essentially straight wood or steel posts with a minimum length of 48 in., unless otherwise shown on the plans. Soft wood posts must be at least 3 in. in diameter or nominal 2 x 4 in. Hardwood posts must have a minimum cross-section of 1½ x 1½ in. T- or L-shaped steel posts must have a minimum weight of 0.95 lb. per foot.

3. **Net Reinforcement.** Provide net reinforcement of at least 14 gauge galvanized welded wire mesh, with a maximum opening size of 2 x 4 in., at least 24 in. wide, unless otherwise shown on the plans.

4. **Staples.** Provide staples with a crown at least ¾ in. wide and legs ½ in. long.

5. **Used Materials.** Use recycled material meeting the applicable requirements if accepted by the Engineer.

K. Curb Inlet Gravel Filters.

1. **Gravel Filter Bags.** Furnish gravel filter bags meeting Section 540.2.I, "Sandbags." Gravel bags shall be filled with ¾ inch gravel.

2. **Concrete Masonry Units.** Hollow, Non-Load-Bearing Concrete blocks of 1500-2000 psi, 28-day compressive strength concrete shall be used with dimensions of 8" x 6" x6" width, height, and length, respectively.

3. **Wood Blocks.** Wolmanized treated 2" x 4" lumber with the length as per inlet size.

540.3. EQUIPMENT. Provide a backhoe, front end loader, blade, scraper, bulldozer, or other equipment as required when "Earthwork for Erosion Control" is specified on the plans as a bid item.

540.4. CONSTRUCTION: The contractor shall provide control measures to prevent or minimize the impact to receiving waters as required by the plans and/or as directed by the Engineer in writing.

A. Contractor Responsibilities.

1. SW3P. Implement the City's Storm Water Pollution Prevention Plan (SWP3) for the project site in accordance with the specific or general storm water permit requirements. Prevent water pollution from storm water associated with construction activity from entering any surface water or private property on or adjacent to the project site. The Contractor shall effectively prevent and control erosion and sedimentation on the site at the earliest practicable time as outlined in the approved schedule. Control measures, where applicable, will be implemented prior to the commencement of each construction operation or immediately after the area has been disturbed.

2. Preconstruction Submittals.

a. Operations on Right of Way. Prior to the start of construction, the Contractor shall submit to the Engineer, for approval, schedules for accomplishment of the pollution control measures in accordance with the Storm Water Pollution Prevention Plan (SW3P). A plan for the disposal of waste materials generated on the project site must be submitted for approval, also. The Contractor shall submit to the Engineer, for approval, the proposed SW3P for the industrial activities (such as hot mix plants, concrete batch plants, or material handling areas) on the right of way.

b. Operations off Right of Way. The Contractor shall provide the Engineer, for information purposes only, proposed methods of pollution control for Contractor operations in areas which are outside the right of way (such as construction and haul roads, field offices, equipment and supply areas, and material sources).

Pollution control measures for the Contractor's facilities off the right of way are not covered by the City's Environmental Protection Agency (EPA) NPDES general permit. The Contractor shall obtain his own Notice of Intent for the off-site operations. These pollution controls will not be measured for payment but shall be performed at the Contractor's expense.

B. General.

1. Phasing. Implement control measures in the area to be disturbed before beginning construction, or as directed. Limit the disturbance to the area shown on the plans or as directed. If, in the opinion of the Engineer, the Contractor cannot control soil erosion and sedimentation resulting from construction operations, the Engineer will limit the disturbed area to that which the Contractor is able to control. Minimize disturbance to vegetation.

2. Rainfall Events. A rain gauge shall be provided by the Contractor and located at the project site. Within 24 hours of a rainfall event of ½ inch or more as measured by the project rain gauge, the Contractor and Inspector will inspect the entire project to

determine the condition of the control measures. Maintain control measures in accordance with Item 540.4.B.3, "Maintenance."

3. **Maintenance.** Correct ineffective control measures in accordance with this section. Implement additional controls as directed. Remove excavated material within the time requirements specified in the applicable storm water permit.

   Following a rain event as described in Item 540.4.B.2, Rainfall Event," sediment will be removed and devices repaired as soon as practicable but no later than 7 days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment needed for repair of control measures.

   In the event of continuous rainfall over a 24-hour period, or other circumstances that preclude equipment operation in the area, the Contractor will hand carry and install additional backup devices as determined by the Engineer. The Contractor will remove silt accumulations and deposit the spoils in an area approved by the Engineer as soon as practical. Any corrective action needed for the control measures will be accomplished in the sequence directed by the Engineer; however, areas adjacent to waterbodies shall generally have priority followed by devices protecting storm sewer inlets.

4. **Stabilization.** Stabilize disturbed areas where construction activities will be temporarily stopped, or construction becomes inactive, in accordance with the applicable storm water permit. Inactive construction areas are defined as areas in which no construction activity will occur for a period of 30 days or longer. Inactive construction areas which have been disturbed will require stabilization through the use of vegetation, mulch, erosion control matting or structural methods within 7 calendar days from the last construction activity in the area. At all times prior to stabilization, inactive construction areas shall be considered as active, disturbed construction area, contributing to the sediment loading at the site control systems. After stabilization, inactive construction areas will be considered undisturbed areas, eliminating the contribution of sediment to the erosion control devices.

5. **Finished Work.** Upon acceptance of vegetative cover, remove and dispose of all temporary control measures, temporary embankments, bridges, matting, falsework, piling, debris, or other obstructions placed during construction that are not a part of the finished work, or as directed. Soil retention blankets shall be removed only when, in the opinion of the Engineer, final permanent perennial seeding would be adversely affected by the presence of an existing soil retention blanket.

   The project will not be accepted until a 70% density of existing adjacent undisturbed areas is obtained, unless otherwise shown on the plans. When shown on the plans, the Engineer may accept the project when adequate controls are in place that will control erosion, sedimentation, and water pollution until sufficient vegetative cover can be established.

6. **Restricted Activities.** Do not locate disposal areas, stockpiles, or haul roads in any wetland, water body, or streambed. Do not install temporary construction crossings in or across any water body without the prior approval of the appropriate resource agency and the Engineer. Restrict construction operations in any water body to the necessary areas as shown on the plans or applicable permit, or as directed. Use temporary bridges, timber mats, or other structurally sound and non-eroding material for stream crossings.

Provide protected storage area for paints, chemicals, solvents, and fertilizers at an approved location. Keep paints, chemicals, solvents, and fertilizers off bare ground and provide shelter for stored chemicals.

C. Installation, Maintenance, and Removal Work. Perform work in accordance with the specific or general storm water permit. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until earthwork construction and permanent erosion control features are in place or the disturbed area has been adequately stabilized as determined by the Engineer. If a device ceases to function as intended, repair or replace the device or portions thereof as necessary. Remove sediment, debris, and litter. When approved, sediments may be disposed of within embankments, or in the right of way in areas where the material will not contribute to further siltation. Dispose of removed material in accordance with federal, state, and local regulations. Remove devices upon approval or when directed. Upon removal, finish-grade and dress the area. Stabilize disturbed areas in accordance with the permit, and as shown on the plans or directed. The Contractor retains ownership of stockpiled material and must remove it from the project when new installations or replacements are no longer required.

1. Rock Filter Dams for Erosion Control. Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams. Place sandbags as a foundation when required or at the Contractor's option. For Types 1, 2, 3, and 5, place the aggregate to the lines, height, and slopes specified, without undue voids. For Types 2 and 3, place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side with wire ties, or hog rings, or as directed. Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed. Construct filter dams according to the following criteria, unless otherwise shown on the plans:

a. Type 1 (Non-reinforced).

(1) Height. At least 18 in. measured vertically from existing ground to top of filter dam.

(2) Top Width. At least 2 ft.

(3) Slopes. At most 2:1.

b. Type 2 (Reinforced).

(1) Height. At least 18 in. measured vertically from existing ground to top of filter dam.

(2) Top Width. At least 2 ft.

(3) Slopes. At most 2:1.

c. Type 3 (Reinforced).

(1) Height. At least 36 in. measured vertically from existing ground to top of filter dam.

(2) Top Width. At least 2 ft.

(3) Slopes. At most 2:1.

d. Type 4 (Sack Gabions). Unfold sack gabions and smooth out kinks and bends. For vertical filling, connect the sides by lacing in a single loop–double loop pattern on 4- to 5-in. spacing. At one end, pull the end lacing rod until tight, wrap around the end, and twist 4 times. At the filling end, fill with stone, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires 4 times. For horizontal filling, place sack flat in a filling trough, fill with stone, and connect sides and secure ends as described above. Lift and place without damaging the gabion. Shape sack gabions to existing contours.

e. Type 5. Provide rock filter dams as shown on the plans.

2. Temporary Pipe Slope Drains. Install pipe with a slope as shown on the plans or as directed. Construct embankment for the drainage system in 8-in. lifts to the required elevations. Hand-tamp the soil around and under the entrance section to the top of the embankment as shown on the plans or as directed. Form the top of the embankment or earth dike over the pipe slope drain at least 1 ft. higher than the top of the inlet pipe at all points. Secure the pipe with hold-downs or hold-down grommets spaced a maximum of 10 ft. on center. Construct the energy dissipaters or sediment traps as shown on the plans or as directed. Construct the sediment trap using concrete in accordance with Item 505, "Concrete Riprap," when designated on the plans. Rubble riprap in accordance with TxDOT Standard Specification Item 432, "Riprap" may also be used when designated on the plans or as directed by the Engineer.

3. Baled Hay for Erosion and Sedimentation Control. Install hay bales at locations shown on the plans by embedding in the soil at least 4 in. and, where possible, approximately ½ the height of the bale, or as directed. Fill gaps between bales with hay.

4. Temporary Paved Flumes. Construct paved flumes as shown on the plans or as directed. Provide excavation and embankment (including compaction of the subgrade) of material to the dimensions shown on the plans, unless otherwise indicated. Install a rock or rubble riprap energy dissipater, constructed from the materials specified above to a minimum depth of 9 in. at the flume outlet to the limits shown on the plans or as directed.

5. Construction Exits. When tracking conditions exist, prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits. Construct exits for either long or short-term use.

a. Long-Term. Place the exit over a foundation course, if necessary. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the plans or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.

(1) Type 1. Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.

(2) Type 2. Construct using railroad ties and timbers as shown on the plans or as directed.

b. Short-Term.

(1) Type 3. Construct using crushed aggregate, plywood, or wafer board. This type of exit may be used for daily operations where long-term exits are not practical.

(2) Type 4. Construct as shown on the plans or as directed.

6. Earthwork for Erosion and Sediment Control. Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.

a. Excavation and Embankment for Erosion Control Features. Place earth dikes, swales or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover. Place swales and dikes at other locations as shown on the plans or as directed to prevent runoff spillover or to divert runoff. Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides. Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the plans or as directed. Where required, create a sediment basin providing 3,600 cu. ft. of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at one time, not including offsite areas.

b. Excavation of Sediment and Debris. Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.

7. Construction Perimeter Fence. Construct, align, and locate fencing as shown on the plans or as directed.

a. Installation of Posts. Embed posts 18 in. deep or adequately anchor in rock, with a spacing of 8 to 10 ft.

b. Wire Attachment. Attach the top wire to the posts at least 3 ft. from the ground. Attach the lower wire midway between the ground and the top wire.

c. Flag Attachment. Attach flagging to both wire strands midway between each post. Use flagging at least 18 in. long. Tie flagging to the wire using a square knot.

8. Sandbags for Erosion Control. Construct a berm or dam of sandbags that will intercept sediment-laden storm water runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Fill each bag with sand so that at least the top 6 in. of the bag is unfilled to allow for proper tying of the open end. Place the sandbags with their tied ends in the same direction. Offset subsequent rows of sandbags ½ the length of the preceding row. Place a single layer of sandbags downstream as a secondary debris trap. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.

9. Temporary Sediment-Control Fence. Provide temporary sediment-control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion-control measures used to control sediment in areas of higher flow. Install the fence as shown on the plans, as specified in this Section, or as directed.

a. Installation of Posts. Embed posts at least 18 in. deep, or adequately anchor, if in rock, with a spacing of 6 to 8 ft. and install on a slight angle toward the run-off source.

b. Fabric Anchoring. Dig trenches along the uphill side of the fence to anchor 6 to 8 in. of fabric. Provide a minimum trench cross-section of 6 x 6 in. Place the fabric against the side of the trench and align approximately 2 in of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.

c. Fabric and Net Reinforcement Attachment. Unless otherwise shown under the plans, attach the reinforcement to wooden posts with staples, or to steel posts with T-clips, in at least 4 places equally spaced. Sewn vertical pockets may be used to attach reinforcement to end posts. Fasten the fabric to the top strand of reinforcement by hog rings or cord every 15 in. or less.

d. Fabric and Net Splices. Locate splices at a fence post with a minimum lap of 6 in. attached in at least 6 places equally spaced, unless otherwise shown under the plans. Do not locate splices in concentrated flow areas. Requirements for installation of used temporary sediment control fence include the following:

- fabric with minimal or no visible signs of biodegradation (weak fibers),
- fabric without excessive patching (more than 1 patch every 15 to 20 ft.),
- posts without bends, and
- backing without holes.

10. Curb Inlet Gravel Filter.

a. Installation. Install the curb inlet gravel filters in the following manner:

(1) Place the 2” x 4” treated lumber in front of and parallel with the opening of the inlet.

(2) Place the Concrete Masonry Units (CMUs) around the inlet, to be protected, in front of the 2” x 4” lumber, with the openings of the CMUs facing the inlet.

(3) Surround the CMUs with gravel bags, making certain that there are no gaps are evident between the gravel bags.

b. Sediment Control. When the accumulated sediment deposit reaches a depth of approximately 6 inches, it shall be removed and disposed of at approved sites in a manner that will not contribute to additional siltation. If the structure ceases to function as intended, the Engineer may direct that the Filter bag be replaced. Such replacement will not be measured for payment. Torn or punctured bags shall be replaced with a new Filter bag.

540.5. MEASUREMENT: If the Contractor is required to install temporary erosion, sediment and water pollution control measures due to his negligence, carelessness, lack of maintenance, or failure to install permanent controls as a part of the work as scheduled, and measures are ordered in writing by the Engineer, such work shall not be measured for payment, but shall be performed at the Contractor's expense.

In case of failure on the part of the Contractor to prevent and control soil erosion, sedimentation and water pollution which may degrade receiving water, the Engineer reserves the right to employ outside assistance or to use City forces to provide the necessary corrective measures. All costs including engineering costs will be deducted from any moneys due or to become due to the Contractor.

When the need for control measures can not be attributed to the contractor's negligence, carelessness, lack of maintenance or failure to install permanent water pollution control measures and these measures are shown on the plans and/or directed by the Engineer, these measures shall be measured and paid for in accordance with contract bid items shown under this section.

A. Rock Filter Dams. Installation or removal of rock filter dams will be measured by the foot or by the cubic yard. The measured volume will include sandbags, when used.

1. **Linear Measurement.** When rock filter dams are measured by the foot, measurement will be along the centerline of the top of the dam.

2. **Volume Measurement.** When rock filter dams are measured by the cubic yard, measurement will be based on the volume of rock computed by the method of average end areas.

    a. **Installation.** Measurement will be made in final position.

    b. **Removal.** Measurement will be made at the point of removal.

B. Temporary Pipe Slope Drains. Temporary pipe slope drains will be measured by the foot.

C. Baled Hay. Baled hay will be measured by each bale.

D. Temporary Paved Flumes. Temporary paved flumes will be measured by the square yard of surface area. The measured area will include the energy dissipater at the flume outlet.

E. Construction Exits. Construction exits will be measured by the square yard of surface area.

F. Earthwork for Erosion and Sediment Control. Earthwork for erosion and sediment control will not be measured directly but will be considered subsidiary to this or other pertinent items.

G. Construction Perimeter Fence. Construction perimeter fence will be measured by the foot.

H. Sandbags for Erosion Control. Sandbags will be measured as each sandbag or by the foot along the top of sandbag berms or dams.

I. Temporary Sediment-Control Fence. Temporary sediment-control fence will be measured by the foot.

J. Curb Inlet Gravel Filter. Curb inlet gravel filter will be measured by the linear foot, as measured on the centerline of the gravel bags installed.

540.6. PAYMENT: The following will not be paid for directly but are subsidiary to pertinent Items:

- erosion-control measures for Contractor project-specific locations (PSLs) inside and outside the right of way (such as construction and haul roads, field offices, equipment and supply areas, plants, and material sources);
- removal of litter;
- repair to devices and features damaged by Contractor operations;
- added measures and maintenance needed due to negligence, carelessness, lack of maintenance, and failure to install permanent controls;
- removal and reinstallation of devices and features needed for the convenience of the Contractor;
- finish grading and dressing upon removal of the device; and
- minor adjustments including but not limited to plumbing posts, reattaching fabric, minor grading to maintain slopes on an erosion embankment feature, or moving small numbers of sandbags.

The Contractor will be reimbursed for maintenance, repair, or reinstallation of devices and features when the need for additional control measures cannot be attributed to the above, as determined by the Engineer. Stabilization of disturbed areas will be paid for under pertinent Items. Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly but is subsidiary to the excavation and embankment under this Item.

Pollution control measures outside the right of way will not be measured for payment but shall be performed at the Contractor's expense.

Control measures as shown on the plans will be paid for in accordance with applicable bid items as shown below:

A. Rock Filter Dams. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows:

1. Installation. Installation will be paid for as "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

2. Removal. Removal will be paid for as "Rock Filter Dams (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

When the Engineer directs that the rock filter dam installation or portions thereof be replaced, payment will be made at the unit price bid for "Rock Filter Dams (Remove)" and for "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals

B. Temporary Pipe Slope Drains. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Pipe Slope Drains" of the size specified. This price is full

compensation for furnishing materials, removal and disposal, furnishing and operating equipment, labor, tools, and incidentals.

Removal of temporary pipe slope drains will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the pipe slope drain installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Pipe Slope Drains" of the size specified, which is full compensation for the removal and reinstallation of the pipe drain.

Earthwork required for the pipe slope drain installation, including construction of the sediment trap, will be measured and paid for under Section 540.5.F, "Earthwork for Erosion and Sediment Control." Riprap concrete or stone, when used as an energy dissipater or as a stabilized sediment trap, will be measured and paid for in accordance with Item 505, "Concrete Riprap" or TxDOT Item 432, "Riprap," respectively.

C. Baled Hay. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Baled Hay." This price is full compensation for furnishing and placing bales, excavating trenches, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the baled hay installation (or portions thereof) be replaced, payment will be made at the unit price bid for "Baled Hay," which is full compensation for removal and reinstallation of the baled hay.

D. Temporary Paved Flumes. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Paved Flume (Install)" or "Temporary Paved Flume (Remove)." This price is full compensation for furnishing and placing materials, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the paved flume installation or portions thereof be replaced, payment will be made at the unit prices bid for "Temporary Paved Flume (Remove)" and "Temporary Paved Flume (Install)." These prices are full compensation for the removal and replacement of the paved flume and for equipment, labor, tools, and incidentals.

Earthwork required for the paved flume installation, including construction of a sediment trap will be considered subsidiary to this item and will not be measured or paid for directly.

E. Construction Exits. Contractor-required construction exits from off right-of-way locations or on-right of way PSLs will not be paid for directly but are subsidiary to pertinent Items.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" for construction exits needed on right-of-way access to work areas required by the Department will be paid for at the unit price bid for "Construction Exits (Install)" of the type specified or "Construction Exits (Remove)." This price is full compensation for furnishing and placing materials, excavating, removal and disposal, cleaning vehicles, labor, tools, and incidentals.

When the Engineer directs that a construction exit or portion thereof be removed and replaced, payment will be made at the unit prices bid for "Construction Exit (Remove)" and "Construction Exit (Install)" of the type specified. These prices are full compensation for the

removal and replacement of the construction exit and for equipment, labor, tools, and incidentals.

Construction of sediment traps used in conjunction with the construction exit will be considered subsidiary to this item and will not be measured or paid for directly.

F. Earthwork for Erosion and Sediment Control. The work performed and materials furnished in accordance with this Item will not be paid for directly but is subsidiary to pertinent Items unless otherwise shown on the plans.

Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

G. Construction Perimeter Fence. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Construction Perimeter Fence." This price is full compensation for furnishing and placing the fence; digging, fence posts, wire, and flagging; removal and disposal; and materials, equipment, labor, tools, and incidentals.

Removal of construction perimeter fence will be not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the perimeter fence installation or portions thereof be removed and replaced, payment will be made at the unit price bid for "Construction Perimeter Fence," which is full compensation for the removal and reinstallation of the construction perimeter fence.

H. Sandbags for Erosion Control. Sandbags will be paid for at the unit price bid for "Sandbags for Erosion Control" (of the height specified when measurement is by the foot). This price is full compensation for materials, placing sandbags, removal and disposal, equipment, labor, tools, and incidentals.

Removal of sandbags will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the sandbag installation or portions thereof be replaced, payment will be made at the unit price bid for "Sandbags for Erosion Control," which is full compensation for the reinstallation of the sandbags.

I. Temporary Sediment-Control Fence. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Sediment-Control Fence." This price is full compensation for furnishing and placing the fence; trenching, fence posts, fabric and backfill; removal and disposal; and equipment, labor, tools, and incidentals.

Removal of temporary sediment-control fence will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the temporary sedimentation control fence installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Sediment-Control Fence," which is full compensation for the removal and reinstallation of the temporary sediment-control fence.

J. Curb Inlet Gravel Filter. The work performed and the materials furnished as specified herein, measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "Curb Inlet Gravel Filter," which payment shall be full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work as specified, including maintaining and replacing the gravel bags as required by these

specifications, removal of accumulated silt, and removal and proper disposal of the "Curb Inlet Gravel Filter" upon completion of site stabilization.

540.7. BID ITEM:

Item 540.1 - Rock Filter Dams (Install/Remove) - per linear foot (Type _)

Item 540.2 - Rock Filter Dams (Install/Remove) - per cubic yard (Type _)

Item 540.3 - Temporary Pipe Slope Drains - per foot (_ inches in diameter)

Item 540.4 - Baled Hay - per bale

Item 540.5 - Temporary Paved Flume (Install/Remove) - per square yard

Item 540.6 - Construction Exits (Install/Remove) - per square yard

Item 540.7 - Construction Perimeter Fence - per foot

Item 540.8 - Sandbags for Erosion Control - per foot (_ inches high)

Item 540.9 - Temporary Sediment-Control Fence - per foot

Item 540.10 - Curb Inlet Gravel Filters - per linear foot

ITEM

618 CONDUIT

618.1. DESCRIPTION: *Furnish and place conduit.*

618.2. MATERIALS: Provide new materials that comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of Item 622, "Duct Cable."

When specified on the plans, provide:

- rigid metal (RM) conduit that is hot-dip galvanized inside and outside with a minimum of 1.5 oz. per square foot of a zinc coating in accordance with Texas Department of Transportation (TxDOT) Standard Specification Item 445, "Galvanizing;"
- electrical metallic tubing (EMT) and intermediate metal conduit (IMC) that is steel, galvanized on the outside, and protected on the inside with a suitable corrosion-resistant material;
- polyvinyl chloride (PVC) conduit that meets the requirements of NEMA Standard TC-2, UL 651, and the NEC;
- high-density polyethylene (HDPE) conduit without factory-installed conductors that meets the requirements of Item 622, "Duct Cable"; or
- flexible conduit that is liquid-tight.

Furnish conduit from new materials that comply with TxDOT DMS-11030, "Conduit."

Provide conduit from manufacturers prequalified by the Texas Department of Transportation. The TxDOT Traffic Operations Division maintains a list of prequalified electrical conduit manufacturers.

Unless otherwise shown on the plans, fabricate fittings such as junction boxes and expansion joints from a material similar to the connecting conduit. Use watertight fittings. Do not use set screw and pressure-cast fittings. Steel compression fittings are permissible. When using HDPE conduit, provide fittings that are UL-listed as electrical conduit connectors or thermally fused using an electrically heated wound wire resistance welding method.

Use red 3-in. 4-mil polyethylene underground warning tape that continuously states "Caution Buried Electrical Line Below."

618.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

618.4. CONSTRUCTION: Place conduit in accordance with the lines, grades, details, and dimensions shown on the plans or as directed. Install conduit a minimum of 18 in. deep underground unless otherwise shown on the plans.

Meet the requirements of the NEC when installing conduit. Secure and support conduit placed for concrete encasement in such a manner that the alignment will not be disturbed during placement of the concrete. Cap ends of conduit and close box openings before concrete is placed.

Ream conduit to remove burrs and sharp edges. Use a standard conduit cutting die with a 3/4-in. taper per foot when conduit is threaded in the field. Fasten conduit placed on structures with conduit straps or hangers as shown on the plans or as directed. Fasten conduit within 3 ft. of each box or fitting and at other locations shown on the plans or as directed. Use metal conduit clamps that are galvanized malleable or stainless steel unless otherwise shown on the plans. Use 2-hole type clamps for 2-in. diameter or larger conduit.

Fit PVC and HDPE conduit terminations with bushings or bell ends. Fit metal conduit terminations with a grounding type bushing, except conduit used for duct cable casing that does not terminate in a ground box and is not exposed at any point. Conduit terminating in threaded bossed fittings does not need a bushing. Prior to installation of conductors or final acceptance, pull a spherical template having a diameter of at least 75% of the inside diameter of the conduit through the conduit to ensure that the conduit is free from obstruction. Cap or plug empty conduit placed for future use.

Perform trench excavation and backfilling as shown on the plans or as directed and in accordance with Item 400, "Excavation, Trenching and Backfilling." Excavation and backfilling will be subsidiary to the installation of the conduit.

Jack and bore as shown on the plans or as directed, and in accordance with Item 406, "Jacking, Boring, or Tunneling."

Place warning tape approximately 10 in. above trenched conduit. Where existing surfacing is removed for placing conduit, repair by backfilling with material equal in composition and density to the surrounding areas and by replacing any removed surfacing, such as asphalt pavement or concrete riprap, with like material to equivalent condition. Mark conduit locations as directed.

618.5. MEASUREMENT: Conduit will be measured by the foot of conduit.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Change Order. Additional measurements or calculations will be made if adjustments of quantities are required.

Boring through soil or rock will be measured in accordance with Item 406, "Jacking, Boring, or Tunneling."

618.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Conduit" of the type and size specified and the installation method specified as applicable. This price is full compensation for furnishing and installing conduit; hanging, strapping, jacking, boring, tunneling, excavating, and furnishing and placing backfill; replacing pavement structure, sod, riprap, curbs, or other surface; marking location of conduit (when required); furnishing and installing fittings, junction boxes, and expansion joints; and equipment, labor, tools and incidentals.

Flexible conduit will not be paid for directly but will be subsidiary to pertinent Items. Unless otherwise shown on the plans, no payment will be allowed under this Item for conduit used on electrical services or in foundations.

618.7. BID ITEM:

Item 618.1 - Conduit (2 inch/PVC Schedule 40) - per foot

Item 618.2 - Conduit (3 inch/PVC Schedule 40) - per foot

Item 618.3 - Conduit (4 inch/PVC Schedule 40) - per foot

Item 618.4 - Conduit (2 inch/PVC Schedule 40) (Bore) - per foot

Item 618.5 - Conduit (3 inch/PVC Schedule 40) (Bore) - per foot

Item 618.6 - Conduit (4 inch/PVC Schedule 40) (Bore) - per foot

Item 618.7 - Conduit (2 inch/PVC Schedule 40) (Bore Rock) - per foot

Item 618.8 - Conduit (3 inch/PVC Schedule 40) (Bore Rock) - per foot

Item 618.9 - Conduit (4 inch/PVC Schedule 40) (Bore Rock) - per foot

ITEM

620 ELECTRICAL CONDUCTORS

620.1. DESCRIPTION: *Furnish and place electrical conductors, except conductors specifically covered by other Items.*

620.2. MATERIALS: Provide new materials that comply with the details shown on the plans and the requirements of this Item. Use solid insulated conductors that are rated for 600 volts; approved for wet locations; and marked in accordance with UL, NEC, and CSA requirements.

A. Electrical Conductors. Furnish electrical conductors in accordance with Texas Department of Transportation DMS-11040, "Electrical Conductors."

B. Suppliers. Provide electrical conductors from manufacturers prequalified by the Texas Department of Transportation (TxDOT). The TxDOT Traffic Operations Division maintains a list of prequalified electrical conductor manufacturers.

C. Grounding Conductors. Ensure that all grounding conductors size AWG No. 8 and larger are stranded, except for the grounding electrode conductor, which will be a solid conductor.

D. Wire Colors. Use white insulation for grounded (neutral) conductors, except that grounded conductors AWG No. 8 and larger may be black with white tape marking at every accessible location. Do not use white insulation or marking for any other conductor except control wiring specifically shown on the plans.

Ensure that insulated grounding conductors are green except that insulated grounding conductors AWG No. 8 and larger may be black with green tape marking at every accessible location. Do not use green insulation or marking for any other conductor except control wiring specifically shown on the plans.

620.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

620.4. CONSTRUCTION: Splice conductors only in junction boxes, ground boxes, and transformer bases, and in poles and structures at the hand holes. Splice as shown on the plans. Do not exceed the manufacturer's recommended pulling tension. Use lubricant as recommended by the manufacturer. Install conductors in accordance with the NEC.

Make insulation resistance tests on the conductors prior to making final connections, and ensure that each continuous run of insulated conductor has a minimum DC resistance of 5 megohms when tested at 1,000 volts DC. The Engineer may require verification testing of all or part of the conductor system. The Engineer will witness these verification tests. Replace conductors exhibiting an insulation resistance of less than 5 megohms.

620.5. MEASUREMENT: This Item will be measured by the foot of each single conductor.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Change Order. Additional measurements or calculations will be made if adjustments of quantities are required.

620.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Electrical Conductors" of the types and sizes specified. This price is full compensation for furnishing, installing, and testing electrical conductors and for equipment, labor, tools, and incidentals, except that:

- conductors used in connecting the components of electrical services will be paid for under Item 628, "Electrical Services";
- conductors used for internal wiring of equipment will not be paid for directly but will be subsidiary to pertinent Items.

620.7. BID ITEM:

Item 620.1 - Electrical Conductors (No. 6) (Bare) - per foot of each single conductor

Item 620.2 - Electrical Conductors (No. 8) (Bare) - per foot of each single conductor

Item 620.3 - Electrical Conductors (No. 6) (Insulated) - per foot of each single conductor

ITEM

624 GROUND BOXES

624.1. DESCRIPTION: *Construct, furnish, and install ground boxes complete with lids.*

624.2. MATERIALS: Provide new materials that comply with the details shown on the plans and meet the following requirements:

A. Cast-In-Place Concrete Ground Boxes. Construct cast-in-place concrete ground boxes and aprons in accordance with Item 300, "Concrete," and Item 301, "Reinforcing Steel."

B. Precast Polymer Concrete Ground Boxes. Provide fabricated precast polymer concrete ground boxes, and precast concrete ground boxes that comply with Texas Department of Transportation DMS-11070, "Ground Boxes."

C. Concrete Apron. Construct a concrete apron, when shown on the plans, in accordance with Item 300, "Concrete," and Item 301, "Reinforcing Steel."

D. Suppliers. Provide ground boxes from manufacturers prequalified by the Texas Department of Transportation (TxDOT). The TxDOT Traffic Operations Division maintains a list of prequalified ground box manufacturers.

624.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

624.4. CONSTRUCTION: Construct and/or place ground boxes in accordance with the appropriate requirements of the Items shown in Section 624.2 "Materials."

624.5. MEASUREMENT: This Item will be measured by each ground box complete in place.

624.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Ground Boxes" of the types and sizes specified. This price is full compensation for excavating and backfilling; constructing, furnishing, and installing the ground boxes and concrete aprons when required; and equipment, labor, materials, tools, and incidentals.

624.7. BID ITEM:

Item 624.1 - Ground Boxes Type A (122311) - per each

Item 624.2 - Ground Boxes Type B (122322) - per each

Item 624.3 - Ground Boxes Type C (162911) - per each

Item 624.4 - Ground Boxes Type D (162922) - per each

Item 624.5 - Ground Boxes Type A (122311) with Apron - per each

Item 624.6 - Ground Boxes Type B (122322) with Apron - per each

Item 624.7 - Ground Boxes Type C (162911) with Apron - per each

Item 624.8 - Ground Boxes Type D (162922) with Apron - per each

ITEM

628 ELECTRICAL SERVICES

628.1. DESCRIPTION: *When installing, furnish and install complete and independent points of electrical service. When removing, remove electrical services.*

628.2. MATERIALS: Provide materials that comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following Items:

A. Steel Structures. Texas Department of Transportation (TxDOT) Standard Specification Item 441, "Steel Structures"

B. Galvanizing. TxDOT Standard Specification Item 445, "Galvanizing"

C. Anchor Bolts. TxDOT Standard Specification Item 449, "Anchor Bolts"

D. Conduit. Item 618, "Conduit"

E. Electrical Conductors. Item 620, "Electrical Conductors"

F. Treated Timber Poles. Item 627, "Treated Timber Poles"

G. Foundations. Item 656, "Foundations for Traffic Control Devices."

H. Electrical Services. For the installation of electrical services, use new materials that meet the requirements of the NEC, UL, CSA, and NEMA, and that comply with TxDOT DMS-11080, "Electrical Services."

I. Suppliers. Furnish electrical services from manufacturers prequalified by the Texas Department of Transportation. The TxDOT Traffic Operations Division maintains a list of prequalified electrical service manufacturers.

628.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

628.4. CONSTRUCTION: Perform work in accordance with the details shown on the plans and the requirements of this Item.

A. Installation. Ensure components of the electrical service meet the requirements of the Electrical Detail Standards. Follow NEC and local utility company requirements when installing the electrical equipment. Coordinate the utility companies' work for providing service.

B. Removal. Coordinate removal with the appropriate utility company before beginning work. Before the removal of the electrical service, disconnect and isolate any existing electrical service equipment in accordance with the utility company's requirements.

Use established industry and utility safety practices while removing electrical service equipment near any overhead utilities.

Remove existing electrical service support a minimum of 2 ft. below finish grade unless otherwise shown on the plans. Repair the remaining hole by backfilling with material equal in composition and density to the surrounding area. Replace any surfacing such as asphalt pavement or concrete riprap with like material to equivalent condition.

Disconnect conductors and remove them from the conduit or duct. Cut off all protruding conduit or duct 6 in. below finish grade. Abandoned conduit or duct need not be removed unless shown on the plans.

Reconnect duct cable, conductors, and conduit to be reused when shown on the plans. Make all splices in ground boxes unless otherwise shown on the plans.

Accept ownership of unsalvageable materials, and dispose of them in accordance with federal, state, and local regulations.

628.5. MEASUREMENT: This Item will be measured by each electrical service installed or removed.

628.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Electrical Services" of the types specified or "Remove Electrical Services."

A. Installation. This price is full compensation for paying all fees, permits, and other costs; making arrangements with the utility company for all work and materials provided by the utility company; furnishing, installing, and connecting all components including poles, service supports, foundations, anchor bolts, riprap, enclosures, switches, breakers, conduit (from the service equipment including the elbow below ground), fittings, conductors (from the service equipment including the elbow below ground), brackets, bolts, hangers, and hardware; and equipment, labor, tools, and incidentals.

Costs for utility-owned power line extensions, connection charges, meter charges, and other charges will be paid for by the City. The City will reimburse the contractor only the amount billed by the utility. No additional amount for supervision of the utility's work will be paid.

B. Removal. This price is full compensation for coordinating with the utility company to disconnect and isolate the electrical service; removing the service supports; backfilling holes; and equipment, labor, tools, and incidentals.

628.7. BID ITEM:

Item 628.1 - Electrical Services - per installation

Item 628.2 - Remove Electrical Services - per removal

ITEM

636 ALUMINUM SIGNS

636.1. DESCRIPTION: *When installing, furnish, fabricate, and erect aluminum signs. Sign supports are provided for under other Items. When replacing, replace existing signs on existing sign supports. When refurbishing, refurbish existing aluminum signs on existing sign supports.*

636.2. MATERIALS:

A. Sign Blanks. Furnish sign blank substrates in accordance with Texas Department of Transportation (TxDOT) DMS-7110, "Aluminum Sign Blanks," and in accordance with the types shown on the plans. Use single-piece sheet-aluminum substrates for Type A (small) signs and extruded aluminum substrates for Type G (ground-mounted) or Type O (overhead-mounted) signs.

B. Sign Face Reflectorization. Reflectorize the sign faces with flat surface reflective sheeting. Furnish sheeting that meets TxDOT DMS-8300, "Sign Face Materials." Use reflective sheeting from the same manufacturer for the entire face of a sign.

C. Sign Messages. Fabricate sign messages to the sizes, types, and colors shown on the plans. Use sign message material from the same manufacturer for the entire message of a sign.

- Ensure that the screened messages have clean, sharp edges and exhibit uniform color and reflectivity. Prevent runs, sags, and voids. Furnish screen inks in accordance with TxDOT DMS-8300.
- Fabricate colored, transparent film legend and reflectorized sheeting legend from materials that meet TxDOT DMS-8300.
- Fabricate nonreflectorized-sheeting legend from materials that meet TxDOT DMS-8300.
- Furnish Type A aluminum signs required as part of a message in conformance with the plans and in accordance with this Item.

D. Hardware. Use galvanized steel, stainless steel, or dichromate-sealed aluminum for bolts, nuts, washers, lock washers, screws, and other sign assembly hardware. Use plastic or nylon washers to avoid tearing the reflective sheeting. Furnish steel or aluminum products in accordance with TxDOT DMS-7120, "Sign Hardware." When dissimilar metals are used, select or insulate metals to prevent corrosion.

E. Sampling. The Engineer will sample in accordance with TxDOT Standard Test Method Tex-726-I.

636.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

636.4. CONSTRUCTION:

A. Fabrication.

1. **Sign Blanks.** Furnish sign blanks to the sizes and shapes shown on the plans and that are free of buckles, warps, burrs, dents, cockles, or other defects. Do not splice individual extruded aluminum panel.

   Complete the fabrication of sign blanks, including the cutting and drilling or punching of holes, before cleaning and degreasing. After cleaning and degreasing, ensure that the substrate does not come into contact with grease, oils, or other contaminants before the application of the reflective sheeting.

2. **Sheeting Application.** Apply sheeting to sign blanks in conformance with the recommended procedures of the sheeting manufacturer. Clean and prepare the outside surface of extruded aluminum flanges in the same manner as the sign panel face.

   Minimize the number of splices in the sheeting. Overlap the lapsplices by at least 1/4 in. Use butt splices for Type D and Type E reflective sheeting. Provide a 1-ft. minimum dimension for any piece of sheeting. Do not splice sheeting for signs fabricated with transparent screen inks or colored transparent films.

3. **Sign Assembly.** Assemble extruded aluminum signs in accordance with the details shown on the plans. Sign face surface variation must not exceed 1/8 in. per foot. Surface misalignment between panels in multi-panel signs must not exceed 1/16 in. at any point.

4. **Decals.** If shown on the plans, code and apply sign identification decals in accordance with TxDOT Item 643, "Sign Identification Decals."

B. Storage and Handling.

Ship, handle, and store completed sign blanks and completed signs so that corners, edges, and faces are not damaged. Damage to the sign face that is not visible when viewed at a distance of 50 ft., night or day, will be acceptable. Replace unacceptable signs. Store all finished signs off the ground and in a vertical position until erected. Store finished signs 60 in. by 60 in. or smaller in a weatherproof building. Larger signs may be stored outside.

C. Cleaning.

Before shop inspection, wash completed signs with a biodegradable cleaning solution acceptable to the manufacturers of the sheeting, colored transparent film, and screen ink to remove grease, oil, dirt, smears, streaks, finger marks, and other foreign material. Wash again before final inspection after erection.

D. Installation.

Install signs as shown on the plans or as directed.

E. Replacement.

Remove the existing signs from the existing supports and replace with new signs, including mounting hardware, as shown on the plans.

F. Refurbishing.

Refurbish existing signs by providing and installing new messages and mounting hardware. Install new reflectorized legend and supplemental signs as shown on the plans.

G. Unsalvageable Material. Accept ownership of unsalvageable materials and dispose of in accordance with federal, state, and local regulations.

636.5. MEASUREMENT: Signs installed or replaced will be measured by the square foot of the sign face. Signs refurbished will be measured by each sign. This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Change Order. Additional measurements or calculations will be made if adjustments of quantities are required.

636.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Aluminum Signs," "Replacing Existing Aluminum Signs," or "Refurbishing Aluminum Signs," of the type specified.

A. Installation. This price is full compensation for furnishing and installing new signs and hardware; fabrication of sign panels; treatment of sign panels required before application of the background materials; application of the background materials and messages to the sign panels; furnishing and fabricating frames, wind beams, stiffeners, or required joint backing strips; furnishing bolts, rivets, screws, fasteners, clamps, brackets, and sign support connections; assembling and erecting the signs; preparing and cleaning the signs; and equipment, materials, labor, tools, and incidentals.

B. Replacement. This price is full compensation for furnishing and installing new aluminum signs and hardware; removal of existing signs; fabrication of sign panels; treatment of sign panels required before application of the background materials; application of the background materials and messages to the sign panels; furnishing and fabricating frames, wind beams, stiffeners, or required joint backing strips; furnishing bolts, rivets, screws, fasteners, clamps, brackets, and sign support connections; assembling and erecting the signs; preparing and cleaning the signs; salvaging and disposing of unsalvageable material; and equipment, materials, labor, tools, and incidentals.

C. Refurbishing. This price is full compensation for modifying existing sign messages; removing and replacing existing route markers, reflectorized legend, or supplemental signs attached to the parent sign; preparing and cleaning the signs; furnishing sheeting and hardware; salvaging and disposing of unsalvageable material; and equipment, materials, labor, tools, and incidentals.

636.7. BID ITEM:

Item 636.1 - Aluminum Signs [Type] - per square foot of sign face

Item 636.2 - Replacing Existing Aluminum Signs [Type] - per square foot of sign face

Item 636.3 - Refurbishing Aluminum Signs [Type] - per each

ITEM

680 INSTALLATION OF HIGHWAY TRAFFIC SIGNALS

680.1. DESCRIPTION: *Install highway traffic signals.*

680.2. MATERIALS: Ensure electrical materials and construction methods conform to the current NEC and additional local utility requirements. Furnish new materials. Ensure all materials and construction methods conform to the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following Items:

A. Roadway Illumination Assemblies. Texas Department of Transportation (TxDOT) Standard Specification Item 610, "Roadway Illumination Assemblies"

B. Zinc-Coated Steel Wire Strand. Item 625, "Zinc-Coated Steel Wire Strand"

C. Treated Timber Poles. Item 627, "Treated Timber Poles"

D. Plywood Signs. Item 634, "Plywood Signs"

E. Aluminum Signs. Item 636, "Aluminum Signs"

F. Foundations for Traffic Control Devices. Item 656, "Foundations for Traffic Control Devices"

G. Controller Assemblies. Provide controller assemblies that meet the requirements of TxDOT DMS-11170, "Traffic Signal Controller Assembly," and the details shown on the plans.

H. Flasher Assemblies. Item 685, "Flashing Beacon Assemblies"

I. Suppliers. Provide control and flasher assemblies from manufacturers prequalified by the Texas Department of Transportation. The TxDOT Traffic Operations Division maintains a list of prequalified control and flasher assembly manufacturers.

J. Sampling and Testing. Sampling and testing of traffic signal controller assemblies will be done in accordance with TxDOT Standard Test Method Tex-1170-T.

680.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

680.4. CONSTRUCTION: Install traffic signal controller foundations in accordance with Item 655, "Controller Foundation and Pedestal Posts."

A. Electrical Requirements.

1. Electrical Services. Make arrangements for electrical services and install and supply materials not provided by the utility company as shown on the plans. Unless otherwise shown on the plans, install 120-volt, single-phase, 60-Hz AC electrical service.

2. Conduit. Install conduit and fittings of the sizes and types shown on the plans. Conduit of larger size than that shown on the plans may be used with no additional compensation,

providing that the same size is used for the entire length of the conduit run. Extend conduit in concrete foundations 2 to 3 in. above the concrete. Seal the ends of each conduit with silicone caulking or other approved sealant after all cables and conductors are installed.

3. **Wiring.** Unless otherwise shown on the plans, furnish solid No. 14 AWG conductors. Install above-ground cables and conductors in rigid metal conduit, except for span wire suspended cables and conductors, drip loops, and electrical wiring inside signal poles. Make power entrances to ground-mounted controllers through underground conduit. Wire each signal installation to operate as shown on the plans.

   Attach ends of wires to properly sized self-insulated solderless terminals. Attach terminals to the wires with a ratchet-type compression crimping tool properly sized to the wire. Place prenumbered identification tags of plastic or tape around each wire adjacent to wire ends in the controller and signal pole terminal blocks.

   Splices will not be permitted except as shown on the plans, unless the Engineer approves each individual splice in writing. Make all allowed splices watertight.

4. **Grounding and Bonding.** Ground and bond conductors in accordance with the NEC. Ensure the resistance from the grounded point of any equipment to the nearest ground rod is less than 1 ohm.

   Install a continuous bare or green insulated copper wire (equipment ground) throughout the electrical system that is the same size as the neutral conductor, but a minimum No. 8 AWG. Connect the equipment ground to all metal conduit, signal poles, controller housing, electrical service ground, ground rods, and all other metal enclosures and raceways.

   Provide copper wire bonding jumpers that are a minimum No. 8 AWG.

B. Controller Assemblies. Construct controller foundations in accordance with Item 655, "Controller Foundation and Pedestal Posts." Immediately before mounting the controller assembly on the foundation, apply a bead of silicone caulk to seal the cabinet base. Seal any space between conduit entering the controller and the foundation with silicone caulk.

Deliver the keys for the controller cabinets to the Engineer when the contract is complete.

Place the instruction manual and wiring diagrams for all equipment in the controller cabinet, inside the controller cabinet.

C. Timber Poles. Furnish ANSI Class 2 timber poles other than for electrical services in accordance with details shown on the plans.

D. Preservation of Sod, Shrubbery, and Trees. Replace sod, shrubbery, and trees damaged during the Contract.

E. Removal and Replacement of Curbs and Walks. Obtain approval from the Engineer before cutting into or removing walks or curbs not shown on the plans to be removed or replaced. Restore any curbs or walks removed equivalent to original condition after work is completed, to the satisfaction of the Engineer.

F. Sign Lighting. Attach sign lighting to traffic signal equipment as shown on the plans.

G. Intersection Illumination. Construct luminaires on signal poles as shown on the plans.

H. Test Period. Operate completed traffic signal installations continuously for at least 30-days in a satisfactory manner. If any Contractor-furnished equipment fails during the 30-day test period, repair or replace that equipment. This repair or replacement, except lamp replacement, will start a new 30-day test period.

Replace materials that are damaged or have failed prior to acceptance. Replace failed or damaged existing signal system components when caused by the Contractor. The City will relieve the Contractor of maintenance responsibilities upon passing a 30-day performance test of the signal system and acceptance of the contract.

680.5. MEASUREMENT: This Item will be measured as each signalized intersection controlled by a single traffic signal controller.

680.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Installation of Highway Traffic Signals" of the type (isolated, system, or flashing beacon) specified. This price is full compensation for furnishing, installing, and testing the completed installation, controller and associated equipment, luminaires, signs and sign lights mounted on signal equipment, timber poles, mounting hardware and steel wire strand; preservation and replacement of damaged sod, shrubbery and trees; removal and replacement of curbs and walks; and equipment, labor, tools, and incidentals. The City will pay for electrical energy consumed by the traffic signal.

New drilled shaft foundations for traffic signal poles will be paid for under Item 308, "Drilled Shafts And Under-Reamed Foundations." Controller foundations will be paid for under Item 655, "Traffic Signal Controller Foundation." New conduit will be paid for under Item 618, "Conduit." New electrical conductors will be paid for under Item 620, "Electrical Conductors." New ground boxes will be paid for under Item 624, "Ground Boxes." New electrical services will be paid for under Item 628, "Electrical Services." New vehicle and pedestrian signal heads will be paid for under Item 682, "Vehicle and Pedestrian Signal Heads." New traffic signal cables will be paid for under Item 684, "Traffic Signal Cables." New traffic signal pole assemblies will be paid for under Item 686, "Traffic Signal Pole Assemblies (Steel)." New traffic signal detectors will be paid for under Item 688, "Pedestrian Detectors and Vehicle Loop Detectors."

680.7. BID ITEM:

Item 680.1 - Installation of Highway Traffic Signals [Isolated] - per each

Item 680.2 - Installation of Highway Traffic Signals [System] - per each

ITEM

682 VEHICLE AND PEDESTRIAN SIGNAL HEADS

682.1. DESCRIPTION: *Furnish and install vehicle and pedestrian signal heads.*

682.2. MATERIALS: Furnish only new materials.

A. Definitions.

1. **Back Plate.** A thin strip of material extending outward from all sides of a signal head.

2. **Incandescent Optical Unit.** The lens, reflector, lamp, lamp receptacle, and associated supporting parts in a signal section.

3. **LED Optical Unit.** The LED lens and associated supporting parts in a signal section.

4. **Louver.** A device mounted to the visor restricting signal face visibility.

5. **Signal Section.** One housing case, housing door, visor, and optical unit.

6. **Signal Face.** One section or an assembly of 2 or more sections facing one direction.

7. **Signal Head.** A unidirectional face or a multidirectional assembly of faces, including back plates and louvers when required, attached at a common location on a support.

B. General. Provide vehicle signal heads in accordance with Texas Department of Transportation (TxDOT) DMS-11120, "Vehicle Signal Heads." Provide vehicle signal heads from manufacturers prequalified by the Texas Department of Transportation. The TxDOT Traffic Operations Division maintains a list of prequalified vehicle signal head manufacturers.

Provide pedestrian signal heads in accordance with TxDOT DMS-11130, "Pedestrian Signal Heads" and Item 683, "LED Countdown Pedestrian Signal Module." Provide pedestrian signal heads from manufacturers prequalified by the Department. The Traffic Operations Division maintains a list of prequalified pedestrian signal head manufacturers.

Supply either aluminum or polycarbonate signal head components that are of the same material and manufacturer for any one project. Use galvanized steel, stainless steel, or dichromate sealed aluminum bolts, nuts, washers, lock washers, screws, and other assembly hardware. When dissimilar metals are used, ensure the metals are selected or insulated to prevent corrosion.

Use closed-cell silicone or closed-cell neoprene gaskets.

682.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

682.4. CONSTRUCTION:

A. Assembly. Assemble individual signal sections in multi-section faces in accordance with the manufacturer's recommendations to form a rigid signal face. Assemble and mount signal heads as shown on the plans. Install louvers and back plates in accordance with the manufacturer's recommendations. Close any openings in an assembled signal head with a plug of the same material and color as the head.

When installing a retrofit replacement LED traffic signal or pedestrian signal lamp unit into an existing signal housing, only remove the existing lens, reflector, and incandescent lamp; fit the new unit securely in the housing door; and connect the new housing unit to the existing electrical wiring or terminal block by means of simple connectors.

B. Wiring. Wire each optical unit to the terminal block located in that signal section by means of solderless wire connectors or binding screws and spade lugs. Wire all sections of a multi-section signal face to the section terminal blocks in which the traffic signal cable is terminated. Maintain the color coding on leads from the individual optical units throughout the signal head, except for the traffic signal cable. Use solderless wire connectors or binding screws and spade lugs for connections to terminal blocks. Use binding screws and spade lugs for field wiring.

682.5. MEASUREMENT: This Item will be measured by each vehicle signal section, pedestrian signal section, back plate, or louver.

682.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Pedestrian Signal Section," "Vehicle Signal Section with Back Plate," or "Louver," of the types and sizes specified. This price is full compensation for furnishing, assembling, and installing the signal sections, back plates and louvers, LED countdown modules, and lenses and optics; mounting attachments; and equipment, labor, tools, and incidentals.

682.7. BID ITEM:

Item 682.1 - Install Vehicle Signal Section with Back Plate (3 second) - per each

Item 682.2 - Install Vehicle Signal Section with Back Plate (4 second) - per each

Item 682.3 - Install Vehicle Signal Section with Back Plate (5 second) - per each

Item 682.4 - Install Pedestrian Signal Section (12 inch) LED (2 Ind) - per each

Item 682.5 - Louver (12 inch) (Adjustable) - per each

ITEM

684 TRAFFIC SIGNAL CABLES

684.1. DESCRIPTION: *Furnish and install traffic signal cables.*

684.2. MATERIALS: Provide polyethylene-jacketed multi-conductor cables in accordance with details shown on the plans. Individual conductors must be copper with polyethylene insulation rated for 600 volts. Furnish new materials. Provide traffic signal cables in accordance with Texas Department of Transportation (TxDOT) DMS-11110, "Traffic Signal Cables." All cable shall be #14 AWG solid copper.

A. Type A Cables. Use Type A cables meeting the requirements of IMSA 20-1 for underground conduit installation or for aerial cable supported by a messenger.

B. Type B Cables. Use Type B cables meeting the requirements of IMSA 20-3 as the integral messenger cable for aerial installations.

C. Type C Cables. Use Type C cables meeting the requirements of IMSA 50-2 for loop detector lead-in installations consisting of 2-conductor shielded cable.

D. Types A and B Cable Materials. Provide the following materials for Type A and B cables:

- Use the size and number of conductors shown on the plans. Unless otherwise shown on the plans, use conductors consisting of solid copper.
- Ensure color coding of conductors and sequence for cables are in compliance with Table 1. Base color is the insulation color. Tracer color is the colored stripe that is part of or is firmly adhered to the insulation surface for the full length of the conductor.
- Ensure 2-conductor cable is of the round twisted type with fillers used where necessary to form a round cable.
- For cables with more than 2 conductors, ensure individual conductors are laid up symmetrically in layers with fillers used when necessary, to produce a uniform assembly of conductors with a firm compact cylindrical core.
- Ensure fillers are a non-metallic, moisture-resistant, non-wicking material.
- Supply conductor assemblies that are covered with a wrapping of a moisture-resistant tape applied to overlap at least 10% of the tape width.
- Ensure that the taped conductor assembly is covered with a tightly fitting black polyethylene jacket that is smooth and free from holes, splits, blisters, and any other imperfections.
- Supply cables that clearly show the name of the manufacturer and the IMSA specification number applied at approximate 2-ft. intervals to the outer surface of the jacket by indent printing.

Table 1
Conductor Color and Sequence for Cables

Conductor No.	Base Color	Tracer Color
1	Black	
2	White	
3	Red	
4	Green	
5	Orange	
6	Blue	
7	White	Black
8	Red	Black
9	Green	Black
10	Orange	Black
11	Blue	Black
12	Black	White
13	Red	White
14	Green	White
15	Blue	White
16	Black	Red
17	White	Red
18	Orange	Red
19	Blue	Red
20	Red	Green
21	Orange	Green

E. Additional Requirements for Type B Cable Materials. Additional material requirements particular to Type B cable are as follows:

- Ensure cables consisting of 5 or more conductors have a 0.25-in. nominal diameter messenger. For the messenger, use Class A galvanized Extra High Strength Steel Strand with 3 or 7 wires.

- A solid strand messenger with 0.134-in. diameter may be used for cables with less than 5 conductors.

- To provide corrosion protection, ensure the messenger strand is coated and the interstices are flooded with a rubber asphalt compound or equivalent.

- Ensure the integral messenger and conductors are enclosed in the jacket forming a cross section similar to a figure 8.

F. Type C Cable Materials. Use the following materials for Type C cables:

- Unless otherwise shown on the plans, use No. 14 AWG solid copper insulated conductors with black insulation on 1 of the 2 conductors and clear insulation on the other conductor. Ensure conductors have a minimum of 2 twists per foot within the cable.

- Use cables that have 100% shield coverage utilizing aluminum bonded to a Mylar film. Ensure the drain wire is stranded tinned copper, 2 AWG sizes less than the conductor, and in continuous contact with the aluminum side of the shield material.

- Ensure the jacket is black polyethylene.
- Use cables that legibly show the name of the manufacturer and the IMSA specification number applied at approximate 2-ft. intervals on a tape under the outer jacket.

G. Sampling. The Engineer may take samples from each roll of each size of cable for establishing conformity to IMSA. The samples will be at least 3 ft. in length. Replace any cable failing to meet IMSA requirements.

684.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

684.4. CONSTRUCTION: For each cable run in underground conduit, coil an extra 5 ft. of cable in each ground box.

Splices are not permitted in Type A and B cables unless shown on the plans or approved by the Engineer in writing. Ensure that splices are watertight.

Make splices between Type C cable and loop detector wires only in the ground box near the loop the cable is servicing. Use non-corrosive solder for splices. Ground the drain wire of Type C cable to earth ground only at the controller or detector cabinet. Ensure the resistance from the drain wire to the ground rod is less than 1 ohm.

Test the cables after installation and prior to any connection to the cables. Cables testing less than 50 megohms insulation resistance at 500 volts will be rejected.

684.5. MEASUREMENT: This Item will be measured by the foot of traffic signal cables.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Change Order. Additional measurements or calculations will be made if adjustments of quantities are required.

684.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Traffic Signal Cables" of the types and sizes specified. This price is full compensation for furnishing and installing materials and for equipment, labor, tools, and incidentals, except as shown below.

Cables inside traffic signal pole assemblies will be paid for under this Item.

Cables used for inside signal heads and controllers or for coils in ground boxes, pole bases, and on span wires will not be paid for directly but will be subsidiary to pertinent Items.

684.7. BID ITEM:

Item 684.1 - Traffic Signal Cables [Type/Size] - per foot

ITEM

685 FLASHING BEACON ASSEMBLIES

685.1. DESCRIPTION: When installing, furnish, fabricate, and erect flashing beacon assemblies. When relocating, remove and relocate existing flashing beacon assemblies. When removing, remove existing flashing beacon assemblies.

685.2. MATERIALS: Furnish new materials in accordance with the following Items and with details shown on the plans:

A. Steel Structures.

1. Overhead. Item 686, "Traffic Signal Pole Assemblies (Steel)"

2. Pedestal Pole. Item 687, "Pedestal Pole Assemblies"

B. Metal for Structures. Item 302, "Metal for Structures"

C. Galvanizing. TxDOT Standard Specification Item 445, "Galvanizing"

D. Anchor Bolts. TxDOT Standard Specification Item 449, "Anchor Bolts"

E. Foundations. Item 656, "Foundations for Traffic Control Devices"

F. Flasher Controller Assemblies. Provide flasher controller assemblies in accordance with TxDOT DMS-11160, "Flasher Controller Assembly."

G. Pedestal Pole Base. Provide pedestal pole bases in accordance with TxDOT DMS-11140, "Pedestal Pole Base."

H. Solar Power Flasher Controller Assembly. When shown on the plans, provide solar powered flasher controller assemblies in accordance with TxDOT DMS-11150, "Solar Power Flasher Controller Assembly."

I. School Flasher Control Unit.

1. Control Device.

a. The School Flasher Control Unit shall be a wireless controller able to receive commands generated by a Location Flasher Programming Device with a modem or a touch tone telephone through a pager service. It shall be compatible with commercial 900 MHz frequency range alpha-numeric paging services using POCSAG/FLEX protocol. The unit shall use a pager receiver that is programmable to respond to one of 100,000 individual codes and at least four group codes, out of possible 1,000 separate group codes. The control unit shall be capable of integration, without special procedures, in to the existing "CPR 2100" system (as supplied by RTC Manufacturing, Inc.).

b. Controller programming software shall be able to reset the POSAG, CAPCODE, and other communications settings of the controller through the serial port.

c. Controller units shall be provided as individual units to be mounted in existing enclosures, on existing back panels in place of a typical solid state time switch.

2. Enclosure.

a. The controller shall be housed in an aluminum enclosure with a means for mounting on a suitable back plate. Mounting holes that provide clearance for at least a #10 screw are required.

b. The enclosure shall not exceed 4 ¾ inches width, 8 inches height and 2 inches depth. Interface to the power line and/or to the flasher cabinet shall be provided by means of a wiring harness (minimum 36 inches long). Each wire shall be appropriately labeled for ease of installation into an existing cabinet.

3. Electrical. The controller unit shall be capable of operating on 12 VDC. or an AC power source between 95 and 135 VAC.

4. Manual Operations. The controller shall be equipped with a push button switch that will allow manual activation and/or deactivation of the relay output. The manually activated or deactivated relay shall remain in the manual condition until the next program is received.

5. Controller Addressing. Each controller unit shall have a programmable unique address which can be individually addressed by the software in the Location Flasher Programming Device.

6. Output Relay. The controller shall have SPDT relay output with contacts rated at 15 amperes resistive at 120 VAC.

7. Antenna. Each controller unit shall be provided with an external, 3Bd Gain, Omni-Directional antenna.

a. Antenna shall be provided with "in base" mounted female BNC type connector (Amphenol #31-221-RFX or equivalent) for connection to supplied cable.

b. Antenna shall be provided with 15' length coaxial cable with male BNC type connector (amphenol #31-4541-RFX or equivalent) for connection to controller unit and antenna respectively.

c. Antenna connector hardware shall be solder type, crimped or screw-on connectors will not be accepted.

J. Suppliers. Provide flasher assemblies, pedestal pole bases, and solar powered flasher controller assemblies from manufacturers prequalified by the Texas Department of Transportation. The TxDOT Traffic Operations Division maintains a list of prequalified flasher assembly, pedestal pole base, and solar power flasher controller assembly manufacturers.

Provide shop drawings for the complete assembly. Refer to the appropriate ASTM or Aluminum Association designation for all materials shown in submittals. Use the fabricator's model number to identify the base in all tests, drawings, documentation, and other references.

685.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

685.4. CONSTRUCTION: For installation and relocation, install foundations in accordance with Item 656, "Foundations for Traffic Control Devices."

A. Fabrication. Provide poles and bases in accordance with Item 687, "Pedestal Pole Assemblies." Provide mild steel anchor bolts in accordance with TxDOT Item 449, "Anchor Bolts." Use galvanized bolts, nuts, and washers.

B. Galvanizing. Galvanize all fabricated parts in accordance with TxDOT Item 445, "Galvanizing." Repair galvanizing for any steel part or member damaged in assembly, transit, or erection, or for any steel part or member welded after galvanizing, in accordance with TxDOT Item 445.3.D, "Repairs."

C. Installation. Install flashing beacon assemblies or solar-powered (photovoltaic) school zone flasher assemblies at the locations shown on the plans or as directed. Unless otherwise shown on the plans, stake the assembly locations for verification by the Engineer.

Install pole, breakaway base, connectors, wiring, signal beacons, sign, and foundation as shown on the plans or as directed. Install the flasher controller assembly on the electrical service pole. Install watertight breakaway electrical fuse holders in all line and neutral conductors at the breakaway base.

Use established industry and utility safety practices to erect assemblies near overhead or underground utilities. Consult with the appropriate utility company prior to beginning such work.

D. Relocation. Disconnect and isolate the electrical power supply prior to removal of the assembly. Remove existing assembly as directed. Unless otherwise directed, salvage existing components such as sign, beacons, pole, and base. Repair or replace lost or damaged components as directed.

Relocate existing assembly to the location shown on the plans or as directed. Install existing assembly at new foundations in accordance with Section 685.4.C, "Installation." Remove existing foundations in accordance with Section 685.4.E, "Removal." Accept ownership of unsalvageable materials and dispose of in accordance with federal, state, and local regulations.

E. Removal. Disconnect and isolate existing electrical power supplies prior to removal of the assembly. Remove existing sign panel, beacons, pole, and base from existing assembly. Store items to be reused or salvaged without damaging. Store sign panels above the ground in a vertical position at locations shown on the plans or as directed. Accept ownership of unsalvageable materials and dispose of in accordance with federal, state, and local regulations.

Unless otherwise shown on the plans, remove abandoned foundations, including steel, to 2 ft. below the finished grade. Backfill with material equal in composition and density to the surrounding area, and replace any surfacing, such as asphalt pavement or concrete riprap, with like material to equivalent condition.

685.5. MEASUREMENT: This Item will be measured by each installed, relocated, or removed flashing beacon assembly.

685.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Install Flashing Beacon Assemblies," "Relocate Flashing Beacon Assemblies," "Remove Flashing Beacon Assemblies," or "Solar-Powered (Photovoltaic) School Zone Flasher Assemblies." The City will pay for electrical energy consumed by the flashing beacon.

New electrical services will be paid for under Item 628, "Electrical Services." For mast arm installation, pole shall be paid for under Item 686, "Traffic Signal Pole Assemblies (Steel)" and the foundation under TxDOT Item 416, "Drilled Shaft Foundations."

A. Installation. This price is full compensation for furnishing, fabricating, galvanizing, assembling, and erecting the flashing beacon assemblies; foundations; furnishing and placing anchor bolts, nuts, washers, and templates; controller; signs, signal heads and LED Lenses; and equipment, materials, labor, tools, and incidentals.

B. Relocation. This price is full compensation for removing the flashing beacon assemblies; removing existing foundations; installing new foundations; furnishing, fabricating, and installing any new components as required and replacing the assembly on its new foundations with all manipulations and electrical work; controller; salvaging; disposal of unsalvageable material; loading and hauling; and equipment, material, labor, tools, and incidentals.

C. Removal. This price is full compensation for removing the various flashing beacon assemblies components; removing the foundations; storing the components to be reused or salvaged; disposal of unsalvageable material; backfilling and surface placement; loading and hauling; and equipment, materials, tools, labor, and incidentals.

D. Installation of Solar-Powered (Photovoltaic) School Zone Flasher Assemblies. This Item will be measured as each complete in place solar-powered (photovoltaic) school zone flasher assembly including photovoltaic modules, batteries, flasher controller assembly including the cabinet, pole, signs, signal heads, LED lenses, internal electrical conductors and connectors, school flasher control unit, and complete mounting assemblies. The school flasher control unit shall include all the components detailed in this specification as well as any additional items needed for a fully functional installation.

685.7. BID ITEM:

Item 685.1 - Install Flashing Beacon Assemblies - per each

Item 685.2 - Relocate Flashing Beacon Assemblies - per each

Item 685.3 - Remove Flashing Beacon Assemblies - per each

Item 685.4 - Solar-Powered (Photovoltaic) School Zone Flasher Assemblies - per each

ITEM

686 TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)

686.1. DESCRIPTION: *When installing, fabricate, furnish, and erect steel cantilever traffic signal pole assemblies. When relocating, remove and relocate steel cantilever traffic signal pole assemblies.*

686.2. MATERIALS: Provide new materials that comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following Items:

A. Concrete. Item 300, "Concrete"

B. Steel Structures. Texas Department of Transportation (TxDOT) Standard Specification Item 441, "Steel Structures"

C. Metal. Item 302, "Metal for Structures"

D. Galvanizing. TxDOT Standard Specification Item 445, "Galvanizing"

E. Anchor Bolts. TxDOT Standard Specification Item 449, "Anchor Bolts." Furnish alloy steel or medium-strength mild steel anchor bolts in accordance with Item 449.2.A, "Bolts and Nuts."

686.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

686.4. Construction.

A. Standard Design. Alternate designs are not acceptable. Deviations that affect the basic structural behavior of the pole are considered to be alternate designs. For deviations that do not affect the basic structural behavior of the pole, submit 3 sets of shop drawings to the City Engineer for approval.

B. Fabrication. Fabricate and weld in accordance with TxDOT Item 441, "Steel Structures"; AWS D1.1, Structural Welding Code—Steel; and the requirements of this Item. Fabrication tolerances are given in Table 1.

Table 1
Conductor Color and Sequence for Cables

Part	Dimension	Tolerance (in.)
Pole and mast arm shaft	Length	±1
	Thickness	+0.12, -0.12
	Difference between flats or diameter	±3/16
	Straightness	1/8 in 10 ft.
	Attachment locations	±1
Base and mast arm mounting plates	Overall	±3/16
	Thickness	+1/4, -0
	Deviations from flat	3/16 in 24 in.
	Spacing between holes	±1/8
	Bolt hole size	±1/16
Anchor bolts	Length	±1/2
	Threaded length	±1/2
	Galvanized length	-1/4
Assembled shaft	Angular orientation	1/16 in 12 in.
	Centering	±3/16
	Twist	3° in 50 ft.

Provide properly fitting components. Provide round or octagonal shafts for poles and mast arms tapered as shown on the plans. Fabricate mast arms straight in the unloaded condition unless otherwise shown on the plans. The City will accept bolted slip joints overlapping by at least 1.5 diameters in mast arms 40 ft. and longer.

Provide circumferential welds only at the ends of the shafts. Provide no more than 2 longitudinal seam welds in shaft sections. Grind or smooth the exterior of longitudinal seam welds to the same appearance as other shaft surfaces. Ensure 100% penetration within 6 in. of circumferential base welds and at least 60% penetration at other locations along the longitudinal seam welds. Use a welding technique that minimizes acid entrapment during later galvanizing. Hot-dip galvanize all fabricated parts in accordance with TxDOT Item 445, "Galvanizing."

Treat welds with Ultrasonic Impact Treatment as shown on the plans after galvanization and with the dead load (actual or simulated) applied. Repair damaged galvanizing in accordance with Section 445.3.D, "Repairs."

Connect the luminaire arm to the pole with simplex fittings. Ensure the fittings have no defects affecting strength or appearance.

Ensure that the design wind speed is identified and permanently visible on the pole base plate and mast arm mounting plate.

Deliver each traffic signal pole assembly with fittings and hardware either installed or packaged with its associated components. Ship all components with a weatherproof tag identifying the manufacturer, contract number, date, and destination of shipment.

C. Installation. Locate traffic signal poles as shown on the plans unless otherwise directed to secure a more desirable location or to avoid conflict with utilities. Stake the traffic signal pole locations for verification by the Engineer.

Construct foundations in accordance with Item 308, "Drilled Shafts and Under-Reamed Foundations." Orient anchor bolts as shown on the plans.

Use established industry and utility safety practices when working near underground or overhead utilities. Consult with the appropriate utility company before beginning such work.

Erect structures after foundation concrete has attained its design strength as required in the plans and Item 300, "Concrete." Coat anchor bolt threads and tighten anchor bolts in accordance with TxDOT Item 449, "Anchor Bolts."

After the traffic signal pole assembly is plumb and all nuts are tight, tack-weld each anchor bolt nut in 2 places to its washer. Tack-weld each washer to the base plate in 2 places. Do not weld components to the bolt. Tack-weld in accordance with TxDOT Item 441, "Steel Structures."

After tack-welding, repair galvanizing damage on bolts, nuts, and washers in accordance with Section 445.3.D, "Repairs." Do not grout between the base plate and the foundation.

D. Relocation. Disconnect and isolate traffic signal cables before removing the pole. Remove existing traffic signal poles as directed. Ensure that the poles or attached components suffer no undue stress or damage. Signs, signal heads, mounting brackets, luminaires, etc., may be left on the poles. Repair or replace damaged components as directed.

Unless otherwise shown on the plans, remove abandoned concrete foundations to a point 2 ft. below final grade. Backfill the hole with materials equal in composition and density to the surrounding area. Replace surfacing material with similar material to an equivalent condition.

Move existing poles to locations shown on the plans or as directed. Install existing poles on new foundations in accordance with Section 686.4.C, "Installation."

Accept ownership of unsalvageable materials and dispose of in accordance with federal, state, and local regulations.

686.5. MEASUREMENT: This Item will be measured by each traffic signal pole assembly installed or relocated.

686.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Install Traffic Signal Pole Assemblies (Steel)" of the types and sizes specified or "Relocate Traffic Signal Pole Assemblies (Steel)" of the types specified.

New drilled shaft foundations will be paid for under Item 308, "Drilled Shafts and Under-Reamed Foundations."

A. Installation. This price is full compensation for furnishing, fabricating, galvanizing, assembling, and erecting the pole upon a foundation; furnishing and erecting required mast arms and luminaire arms; furnishing and placing anchor bolts, nuts, washers, and templates; and equipment, materials, labor, tools, and incidentals.

B. Relocation. This price is full compensation for removing traffic signal poles; removing existing foundations; backfilling and surface placement; storing the components to be reused or salvaged; furnishing, fabricating, and installing required new components; placing and

securing traffic signal poles on new foundations; furnishing and placing conduit, ground rods, and wiring; disposal of unsalvageable material; loading and hauling; and equipment, material, labor, tools, and incidentals.

686.7. BID ITEM:

Item 686.1 - Install Traffic Signal Pole Assemblies (Steel) [Type/Size] - per each

Item 686.2 - Relocate Traffic Signal Pole Assemblies (Steel) [Type] - per each

ITEM

691 SPREAD SPECTRUM RADIOS FOR TRAFFIC SIGNALS

691.1. DESCRIPTION: *Furnish and install spread spectrum radios.*

691.2. MATERIALS: Supply complete manufacturer specifications for radio, antennas, cables, connectors, power supply, mounting hardware, and lightning surge protector, including the exact gain of the antenna.

A. Spread Spectrum Radio. Furnish spread spectrum radios with the following operating minimum characteristics:

FREQUENCY	902 - 928 MHz
RANGE	15 Miles line of sight
REPEAT CAPABILITIES	Store and Forward Repeater Capabilities
POWER	1.0 Watt Transmitting Power
ENVIRONMENT	Temperature -22°F to 140°F
FCC APPROVAL	No License Requirements Type acceptance under FCC Part 15.247
DATA CHARACTERISTICS	Half or Full Duplex Operation RS232C interface Selectable1,200 thru 19,200 bps
REGULATED POWER SUPPLY	Voltage 12 DC Amperage 3 Amp Operating Temp -22°F to 140°F

Install the radios as shown on the plans or as directed.

Supply radios with diagnostic software capable of testing the link between the master radio and the remote radios. Provide software capable of detecting channels which are not adequate for the transmission of data and allow for the exclusion of these frequencies in the selection of frequencies to be scanned.

B. Radio Antenna. Furnish radio antennas with the following minimum characteristics:

REMOTE SITE	Unidirectional (Yagi), Minimum 9 dB gain (dB reference to half wave dipole)
MASTER SITE	Omni-directional, Minimum 6 dB gain (dB reference to half wave dipole)
RANGE	15 Miles
IMPEDANCE	50 Ohm
WIND RATING	125 miles per hour
CONNECTORS	Type “N” Female

Mount the antenna on a traffic signal pole, an illumination pole, or a separate steel pole as directed. Ground the antenna to the metal support. Do not use a wood pole or support.

C. Cable. Furnish low loss coaxial cable with the following minimum characteristics:

NOMINAL IMPEDANCE	50 Ohm
MAX ATTENUATION	4.2 dB/100 ft. at 900 MHz

Furnish heliax type cable for runs over 100 ft. in length. Furnish cable connectors with a type "N" male connector. Install cable connectors in accordance with manufacturer's recommendations. Install cable as shown on the plans or as directed.

Furnish a coaxial protector (PolyPhaser IS-50NX-C2, Andrew APG-BNFNF- 090, Huber Suhner 3400-41-0048, or equivalent). Mount coaxial protector adjacent to and bonded to the cabinet ground bus

691.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

691.4. CONSTRUCTION:

A. Testing. Provide a factory certified representative for installation and testing of the equipment. Conduct a test site survey prior to the installation of the equipment. The City reserves the right to conduct their own site survey as needed.

B. Training. When required, provide up to 2 days of training to personnel of the Department in the operation, setup and maintenance of the spread spectrum radio system. Provide instruction and materials for a maximum of 20 persons and at a location selected by the Department. Provide instruction personnel certified by the manufacturer. The User's Guide is not an adequate substitute for practical classroom training and formal certification.

C. Warranty. Provide equipment with no less than 95% of the manufacturer's standard warranty remaining when equipment invoices are submitted for payment. Any equipment with less than 95% of its warranty remaining will not be accepted.

Provide updates of the spread spectrum radio software free of charge during the warranty period, including the update to NTCIP compliancy.

691.5. MEASUREMENT: This Item will be measured by each spread spectrum radio, antenna and by the linear foot of cable furnished and installed.

691.6. PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Spread Spectrum Radio", "Antenna" of the type specified, "Coaxial Cable" and "Heliax Cable". The price is full compensation for furnishing, assembling, and installing the spread spectrum radios, antennas, and the cable; for mounting attachments; for testing, labor, tools, equipment and incidentals.

691.7. BID ITEM:

Item 691.1 - Spread Spectrum Radio - per each

Item 691.2 - Antenna [Type] - per each

Item 691.3 - Coaxial Cable - per each

Item 691.4 - Heliax Cable - per each

Update: September 2025

THE FOLLOWING ITEMS ARE SPECIAL PROVISIONS TO THE CITY OF SAN ANTONIO STANDARD SPECIFICATIONS FOR CONSTRUCTION DATED JUNE 2008

General

1. None

Standard Specifications

1. Delete Item 526 – Field Office *(dated June 2008)* in its entirety and replace with Item 526 – Field Office *(dated September 2025)* shown on the attached document.

ITEM

526 FIELD OFFICE

526.1. DESCRIPTION: *This item shall govern the erection or furnishing of a building to be used by City of San Antonio personnel as a Field Office where the total contract amount (including Joint Bid Utilities) is one million dollars or greater.*

526.2. EQUIPMENT:

A. General. Furnish facilities after the receipt of the notice to proceed and before beginning physical work on the project. Provide field offices of the type specified near the worksite at a location acceptable to the Engineer. The Contractor may make use of permanent buildings or rental space excluding single/multiple family dwellings meeting the requirements for field offices instead of portable buildings if approved. Maintain and clean the field office weekly until final completion of the project. Furnish other equipment as required.

B. Damage. Immediately repair or replace the facility if it is damaged in any manner. Payment for repair will be made at no cost to the City.

C. Right-Of-Way. When facilities are allowed in the right of way, remove buildings and other facilities and restore the right of way before project acceptance.

D. Parking and Fencing. Provide 6" compacted gravel parking area for the sole use of at least 2 vehicles for City personnel. Situate the area near the field office at a location acceptable to the Engineer. Maintain the parking area until the project is completed and restore the area to a condition acceptable to the Engineer upon project completion. Enclose the field office and the parking area with a 6-ft. chain-link fence, a top-mounted 3-strand barbed wire, and a 12-ft. gate.

E. Field Office.

Provide field offices with roofs, floors, doors, and screened windows. The building shall be a minimum of 10 feet by 25 feet by 8 feet high with not less than three glass windows and one door. Ensure the floor has an impervious floor covering.

Ensure that the field office is weatherproof, piped for potable water, and electrically wired by certified personnel. Furnish and install adequate outlets, lighting, air conditioning, heating, and ventilation.

Provide a partitioned rest room furnished with rest room supplies, a lavatory and a flush toilet connected to a sewer or septic tank. A portable toilet may be used when approved by the Engineer.

Provide secured and controlled access to the field office through the use of security measures such as bars, alarms, or security fencing. Furnish steps to the building if deemed necessary by the Engineer.

Provide three tables not less than 3 ft. wide and 8 ft. long plus 16 chairs, and filing cabinets in the quantity acceptable to the Engineer. Provide solar screens, blinds, or shades if deemed necessary by the Engineer.

Field Office provided shall have been issued and comply with Certificate of Occupancy.

Provide a telephone service unless otherwise directed.

Provide four sets of keys to COSA Project Manager

Provide all of the following in accordance with the requirements therein:

- 2- workstations meeting the follow minimum requirements:

  a. 2 - 27" Widescreen Display, resolution 2560x1440, with Displayport/HDMI or DVI support
  b. Docking station with support for dual monitors (of a type as above), keyboard, ethernet connection, Thunderbolt/USB-C
  c. Full size keyboard with tenkey
  d. Wired mouse with scroll wheel,
  e. Mousepad
  f. Category 5e Ethernet cable (or better) of a length to run from the docking station to the supplied router as noted below.
  g. Backup Device – 1 TB (terabyte) External hard drive and/or USB Flash Drive

- Color printer: print, copy, scan wide-format printing up to 11 x 17 inches

- Display screen meeting the following minimum requirements:
  a. Diagonal Screen Size: 32"
  b. Wall-mountable
  c. HDMI & USB ports
  d. Resolution: 1080p

  Provide all materials, equipment, tools, labor and incidentals necessary to mount display screen on Field Office wall as directed by Project Manager.

- Provide HDMI cable compatible with provided Display Screen with sufficient length to reach the supplied meeting table.

- Provide, maintain, and pay for hard wired internet access via service such as Cable, DSL, Satellite or other systems that provide a minimum upload and download speeds of:

  a. Download: 50.0 Mbps
  b. Upload: 10.0 Mbps

- Provide one (1) Wireless Router with the following minimum criteria:
  a. Dual-band
  b. 1.3Gbps (5GHz) / 600Mbps (2.4GHz) minimum
  c. 4 Gigabit Ethernet ports
  d. Internet (WAN) port
  e. USP port
  f. 1 GHz Dual-core processor
  g. 802.11 b/g/n/ac
  h. Wirelessly connect a minimum of 10 devices at one time.

- Provide one (1) Digital Camera with the following minimum criteria:
  a. Memory card 16 GB or greater and appropriate software to transfer pictures and video

526.3. MEASUREMENT: No measurement will be made under this item.

526.4. PAYMENT: No payment will be made under this item. The Field Office and items listed above are not a pay item and shall remain the property of the contractor after completion of this project.

526.5. BID ITEM: N/A

Item 503
Portable Changeable Message Sign

1. DESCRIPTION

Furnish, operate, and maintain trailer-mounted portable changeable message sign (PCMS) units.

2. MATERIALS

Furnish new or used material in accordance with this Item and as shown on the plans. Provide a self-contained PCMS unit with the following:

- sign controller,
- changeable message sign,
- trailer, and
- power source.

Paint the exterior surfaces of the power supply housing, supports, trailer, and sign with Federal Orange No. 22246 or Federal Yellow No. 13538 of Federal Standard 595C, except paint the sign face assembly flat black.

2.1. **Sign Controller.** Provide the following.

- A controller with permanent storage of at least 75 pre-programmed messages
- An external input device for random programming and storage of at least 75 additional messages
- A controller capable of displaying up to three messages sequentially
- A controller with adjustable display rates

Enclose sign controller equipment in a lockable enclosure.

2.2. **Changeable Message Sign.** Provide the following.

- A sign capable of being elevated to at least 7 ft. above the roadway surface from the bottom of the sign
- A sign capable of being rotated 360° and secured against movement in any position
- A sign with three separate lines of text and eight characters per line minimum
- A minimum 18-in. character height
- A 5 × 7-character pixel matrix
- A message legibility distance of 600 ft. for nighttime conditions and 800 ft. for normal daylight conditions
- Capability for manual and automatic dimming light sources

The following are descriptions for three screen types of PCMS.

- **Character Modular Matrix.** This screen type comprises of character blocks.
- **Continuous Line Matrix.** This screen type uses proportionally spaced fonts for each line of text.
- **Full Matrix.** This screen type uses proportionally spaced fonts, varies the height of characters, and displays simple graphics on the entire sign.

2.3. **Trailer.** Provide a two-wheel trailer with square top fenders, four leveling jacks, and trailer lights. Do not exceed an overall trailer width of 96 in. Shock mount the electronics and sign assembly.

2.4. **Power Source.** Provide a diesel generator, solar powered power source, or both. Provide a backup power source as necessary.

2.5. **Cellular Modem.** When shown on the plans, provide a cellular modem connection to communicate with the PCMS unit remotely.

3. CONSTRUCTION

Place or relocate PCMS units as shown on the plans or as directed. The plans will show the number of PCMS units needed, for how many days, and for which construction phases.

Maintain the PCMS units in good working condition. Repair damaged or malfunctioning PCMS units as soon as possible. PCMS units will remain the property of the Contractor.

4. MEASUREMENT

This Item will be measured by each PCMS or by the day used. All PCMS units must be set up on a work area and operational before a calendar day can be considered measurable. When measurement by the day is specified, a day will be measured for each PCMS set up and operational on the worksite.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Portable Changeable Message Sign." This price is full compensation for PCMS units; setup; relocating; removing; replacement parts; batteries (when required); fuel, oil, and oil filters (when required); cellular telephone charge (when required); software; and equipment, materials, tools, labor, and incidentals. Reimbursement for the repair of damaged devices will be in accordance with Section 7.17.1., "Reimbursable Repair."

ITEM NO. 826

Existing Valve Box Adjustments

826.1 DESCRIPTION: This Item shall consist with the adjusting of existing valve boxes in accordance with these specifications and as directed by the Engineer.

826.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 826 refer to the current reference standard published at the time of the latest revision.

1. San Antonio Water System (SAWS):
   a. Specifications for Water and Sanitary Sewer Construction
   b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications
3. American Society for Testing and Materials (ASTM) International:
   a. ASTM A 48 - Standard Specification for Gray Iron Castings.
   b. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   c. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
   d. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   e. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   f. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.
4. American Association of State Highway and Transportation Officials (AASHTO):
   a. M306 Standard Specification for Drainage. Sewer Utility and Related Changes

826.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings and certifications. All submittals shall be in accordance with Engineer's requirements and submittals shall be approved prior to delivery.

826.4 MATERIALS: The materials for valve boxes shall conform to the specifications contained within the latest revision of SAWS Material Specification Item No. 10-20, "Valve Boxes."

826.5 CONSTRUCTION:

1. The valve box shall be placed in such a manner to prevent shock or stress from being transmitted to the valve.
2. It shall be centered and plumb over the operating nut of the valve with the box cover flush with the surface of the finished proposed pavement or existing pavement elevation.
3. Valve boxes located in streets or other area subject to vehicular traffic shall be provided with concrete collars as shown in the DD-828 Standard Drawing Series.
4. Collars around such valve boxes shall be formed and finished off neatly and in

a workmanlike manner.

5. Valve box shall be located so that the valve operating nut is readily accessible for operation through the opening in the valve box.
6. The valve box shall be set flush with the surface of the finished pavement or at such other elevations as may be specified.
7. Existing valve boxes shall be defined as boxes which are located within the right-of-way of the specified area of construction operations and are in conflict. These boxes shall be adjusted to match proposed finished grades.

826.6 MEASUREMENT: Adjustment of existing valve boxes will be measured by the unit of valve boxes adjusted to the finished grade.

826.7 PAYMENT:

1. Payment for "Valve Box Adjustment" shall be made at the contract unit price.
2. Adjustments to “existing valves” are incidental to the installation of the valve and are paid for as part of Item Nos. 828 Gate Valves, 830 Butterfly Valves or 832 Tapping Sleeves and Valves of these specifications.
3. Separate pay shall not be given to adjust "existing valves" to finished grade.
4. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 Mobilization

- End of Specification -