CITY OF HOUSTON
INVITATION TO BID

April 2, 2010

Bid Opening:
Sealed bids, in duplicate, will be received by the City Secretary of the City of Houston, in the City Hall Annex, Public Level, 900 Bagby, Houston, Texas 77002 until **10:30 A.M. Thursday, April 22, 2010**, and all bids will be opened and publicly read in the City Council Chamber, City Hall Annex, Public Level, 900 Bagby at 11:00 A.M. on that date for the purchase of:

PIERCE ELEVATED PARKING LOT IMPROVEMENTS
FOR THE GENERAL SERVICES DEPARTMENT
Bid No. S50-C23579
NIGP Code: 913-75 / 913-94

Buyer:
Questions regarding this solicitation should be addressed to Arturo Lopez, Senior Procurement Specialist**, at 832-393-8731 or e-mail to arturo.lopez@cityofhouston.net**

Electronic Bidding:
In order to submit a bid for the items associated with this procurement, you must fill in the pricing information on the "**PLACE BID"** page.

Prebid Conference:
A Pre-Bid Conference will be held for all Prospective Bidders in the Strategic Purchasing Division, Concourse Level (Basement), Conference Room #1, City Hall, 901 Bagby, at 10:00 am. on Tuesday, April 13, 2010. The site visit will be scheduled at the pre-bid conference.

All Prospective Bidders are urged to be present. It is the bidder's responsibility to ensure that they have secured and thoroughly reviewed all aspects of the solicitation documents prior to the Pre-Bid Conference. Any revisions to be incorporated into this solicitation document arising from discussions before, during and subsequent to the Pre-Bid Conference will be confirmed in writing by Letter(s) of Clarification prior to the bid due date. Verbal responses will not otherwise alter the specifications, terms and conditions as stated herein.

Bidding forms, specifications, and all necessary information should be downloaded from the Internet at www.houstontx.gov/purchasing/index.html. By registering and downloading this solicitation document, all updates to this solicitation document will be automatically forwarded via e-mail to any registered bidders. This information may also be obtained from the Supplier Assistance Desk, Strategic Purchasing Division, 901 Bagby, Concourse Level, Houston, Texas 77002.

The place of the bid opening may be transferred in accordance with Paragraph (b), (5) of Section 15-3 of The Code of Ordinances, Houston, Texas. The bid-opening meeting may be rescheduled in accordance with Paragraph (b), (6) of said Section 15-3.

The City reserves the right to reject any or all bids or to accept any bid or combination of bids deemed advantageous to it.
City employees are prohibited from bidding on this solicitation in accordance with the Code of Ordinances Section 15-1.

*__CONTENTS__:

A. OFFER
B. SCOPE OF WORK/SPECIFICATIONS
C. GENERAL TERMS AND CONDITIONS, GENERAL, SUPPLEMENTAL CONDITIONS AND BOND FORMS

*NOTE 1: Actual page numbers for each section may change when the solicitation document is downloaded from the Internet or because of letters of clarification. Therefore, bidders must read the solicitation document in its entirety and comply with all the requirements set forth therein.
***NOTE 2: To be considered for award please submit the electronic bid form and the forms listed in section A, including the signature page, which must be signed by a company official authorized to bind the company and a 10% Bid Bond.**

SECTION A

FORMAL ONE-TIME BID
PIERCE ELEVATED PARKING LOT IMPROVEMENTS
FOR THE GENERAL SERVICES DEPARTMENT
Bid No. S50-C23579
NIGP Code: 913-75 / 913-94

To The Honorable Mayor
and City Council Members
of the City of Houston, Texas (the "City"):

The undersigned hereby offers to provide services necessary for the **Pierce Elevated Parking Lot Improvements, from Louisiana to Johnson Street for the General Services Department**, F.O.B. destination point Houston, Texas, in accordance with the City's Specifications and General Terms & Conditions and/or samples/drawings provided herein. When issued by the City of Houston, Letters of Clarification shall automatically become part of this bid document and shall supersede any previous specifications or provisions in conflict with Letters of Clarification. It is the responsibility of the bidder to ensure that it has obtained all such letters. By submitting a bid on this project, bidder shall be deemed to have received all Letters of Clarification and to have incorporated them into the bid.

The City may accept this bid offer by issuance of a Notice of Award Letter and/or a Purchase Order at any time on or before the 120th day following the day this Official Bid Form is opened by the City. This offer shall be irrevocable for 120 days after bid opening or for 90 days after City Council awards the bid, whichever comes last, but this period may be extended by written agreement of the parties.

The City reserves the right to INCREASE quantities during the twelve-month period following the issuance of the first purchase order subject to agreement in writing by the Prime Contractor/Supplier to honor the same bid price.

The City reserves the option, after bids are opened, to adjust the quantities listed on the electronic bid form upward or downward, subject to the availability of funds, and/or make award (s) on a line item basis.

SECTION A

Documents/forms must be downloaded from the City's Website
http://www.houstontx.gov/purchasing/index.html

Additional Required Forms to be Included with this bid:

In addition to the electronic Bid Form and the Official Signature Page, the Forms listed in Table 1 **must be completed and submitted to the Office of the City Secretary on or before the date and time the bid is due:**

Table 1
Affidavit of Ownership
Fair Campaign Ordinance
Statement of Residence
Conflict of Interest Questionnaire
10% Bid Bond
Contractor References / Questionnaire
Pay or Play Health Insurance Program Acknowledgement Form 1A

Table 2 lists other documents and forms that should be viewed/downloaded from the City's website, but are not required to be submitted with the bid. The City will request these forms, as applicable, to be completed and submitted to the City by the recommended/successful bidder:

Table 2
Formal Instructions for Bid Terms
Drug Forms
Sample Insurance Certificate / Over $50,000
Construction Insurance OCP
Construction 2010 Engineering Construction Wage Rate
Pay or Play Certification of Agreement Form 2
Pay or Play Form 3 / List of all Subcontractors
Bonds for Construction

Questions concerning the Bid should be submitted in writing to: City of Houston, Strategic Purchasing Division, 901 Bagby, Room B506, Houston, TX 77002, Attn: Arturo Lopez or via fax: 832-393-8759 or via email (preferred method) to arturo.lopez@cityofhouston.net no later than ***4:00 PM, Friday, April 16, 2010.***

PERMITS:

Successful Contractor shall be responsible for securing any and all permits for proposed work. Any fee charged for these permits should be the responsibility of the Contractor and not the City of Houston.

CITY BUILDING CODES:

All work performed or equipment installed shall be in strict accordance with the City of Houston Building Codes. The Contractor will immediately correct any deficiencies discovered during work or after completion. Failure to correct deficiencies will result in the City having corrections made at the Contractor's expense.

BID BOND:

The Contractor shall be required to provide and submit with the bid a Bid Bond in the amount of 10% of the total amount bid by the Contractor. The Bid Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this Bidder (as "Principal") and by a corporate surety company licensed to do business in the State of Texas, and if the amount of the bond is greater than $100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury, or a Cashier's or a Certified check in a like amount. Company or personal checks are not acceptable.

PERFORMANCE BOND and PAYMENT BOND:

The successful Contractor(s) shall be required to provide a Performance and Payment Bond in the total amount (100%) of the Contract if the award is in excess of $25,000.00.

The Performance and/or Payment Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this bidder (as "Principal") and by an incorporated surety company licensed to do business in the State of Texas. If the amount of the bond is greater than $100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury.

The Contractor(s) shall be required to provide a Performance and/or Payment Bond as outlined above, which will be delivered to the City Purchasing Agent of the City, on or before the tenth (10th) day following the day the bidder receives notice from the City.

MAINTENANCE BOND:

The Contractor shall furnish a maintenance bond in the total (100%) bid amount in the form required by the City (samples attached). One bond, also referred to as the One Year Maintenance Bond, will be conditioned upon Contractor's repair, replacement or restoration of any work or any portion of the work which is found to be defective or fails in any way to comply strictly with this contract or the plans and specifications for such work within a period of one (1) year from the date of acceptance of such work by the City Council or after the date that the "CO", or his designee in writing, determines, in a written notice to the Contractor, to be the date upon which the project is both substantially complete and available for the full and beneficial occupancy or use of the City.

QUALITY AND WORKMANSHIP

The bidder must be able to demonstrate upon request that it has performed satisfactorily, services similar to the services specified herein. The bidder will provide records of warranty and repair services performed for others upon request. The City of Houston shall be the sole judge whether the services performed are similar to the scope of services specified herein.

CONTRACTOR'S QUESTIONNAIRE

In order to receive bid award consideration, the bidder must be able to demonstrate that they are currently providing or have had at least one contract, similar in size and scope, for **Parking Lot Improvements** that is similar in size and scope to this contract. **Bidder must have references documenting that it has performed parking lot improvements of a similar size and scope as stipulated in the scope of work / specifications and attendant drawings.** The reference(s) should be included in the space provided below. Please attach another piece of paper if necessary. If references are not included with the bid, the bidder shall be required to provide such references to the City of Houston within five working days from receipt of a written request from the City of Houston to do so. **Bidder's capability and experience shall be a factor in determining the Contractor's responsibility.**

1. Business Name: _____

   Business Address:_____

   City, State, Zip _____

   Name of Owner/Contact Person: _____

   Phone: _____ Fax: _____Email:_____

   No. of Years providing Service to this business:_____

2. Business Name: _____

   Business Address:_____

   City, State, Zip:

   _____

   Name of Owner/Contact Person:

   _____

   Phone: _____ Fax: _____ Email:_____

   No. of Years providing Service to this business:_____

3. Business Name: _____

   Business Address:_____

   City, State, Zip:

   _____

   Name of Owner/Contact Person:

   _____

   Phone: _____Fax: _____Email:_____

   No. of Years providing Service to this business:_____

SITE INSPECTION

The City of Houston reserves the right to inspect the bidder's current place of business to evaluate equipment condition and capabilities, staff experience, training and capabilities, and storage capabilities as they relate to the performance of this contract.

SECTION B
SCOPE OF WORK/SPECIFICATIONS

1.0 General

1.1 The contractor shall provide all materials, labor, equipment, transportation, insurance, permits, bonds and other services necessary to prepare existing surface of the asphalt parking lot and fill existing cracks and pot holes for new slurry seal coating; install slurry seal coating; paint striping for parking spaces; provide new metal fencing; install electrical for lighting and existing security booth; provide and install new entrance sign and address drainage improvements.

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS
AND ENGINEERING

STANDARD CONSTRUCTION SPECIFICATIONS
FOR
WASTEWATER COLLECTION SYSTEMS,
WATER LINES, STORM DRAINAGE, AND STREET PAVING

Jon C. Vanden Bosch, P.E.
Director

Showri Nandagiri, P.E.
City Engineer

OCTOBER 2002

Table of Contents

COH SPECIFICATIONS

Doc. No.	Document Title	Doc. Date
	DIVISION 2 - SITE WORK	
02081	CAST-IN-PLACE CONCRETE MANHOLES	10-01-2002
02082S	Precast Concrete Manholes	01-07-2003
02082	PRECAST CONCRETE MANHOLES	10-01-2002
02084	FRAMES, GRATES, RINGS, AND COVERS	10-01-2002
02086	ADJUSTING MANHOLES, INLETS, AND VALVE BOXES TO GRADE	10-01-2002
02087	BRICK MANHOLE FOR STORM SEWERS	10-01-2002
02221	REMOVING EXISTING PAVEMENTS AND STRUCTURES	10-01-2002
02222	ABANDONMENT OF SEWERS	10-01-2002
02233	CLEARING AND GRUBBING	10-01-2002
02315	ROADWAY EXCAVATION	10-01-2002
02316S	Excavation And Backfill For Structures	01-08-2003
02316	EXCAVATION AND BACKFILL FOR STRUCTURES	10-01-2002
02317S	Excavation And Backfill For Utilities	12-02-2003
02317	EXCAVATION AND BACKFILL FOR UTILITIES	10-01-2002
02318S	Extra Unit Price Work For Excavation and Backfill	01-07-2003
02318	EXTRA UNIT PRICE WORK FOR EXCAVATION AND BACKFILL	10-01-2002
02320	UTILITY BACKFILL MATERIALS	10-01-2002
02321	CEMENT STABILIZED SAND	10-01-2002
02336	LIME-STABILIZED SUBGRADE	10-01-2002
02338	PORTLAND CEMENT STABILIZED SUBGRADE	10-01-2002
02500	MILLING	10-01-2002
02501	DUCTILE IRON PIPE AND FITTINGS	10-01-2002
02502	STEEL PIPE AND FITTINGS	10-01-2002
02504	CENTRIFUGALLY CAST FIBERGLASS PIPE	10-01-2002
02506	POLYVINYL CHLORIDE PIPE	10-01-2002
02511	WATER LINES	10-01-2002
02512	WATER TAP AND SERVICE LINE INSTALLATION	10-01-2002
02513	WET CONNECTIONS	10-01-2002
02514	DISINFECTION OF WATER LINES	10-01-2002
02515	HYDROSTATIC TESTING OF PIPELINES	10-01-2002
02516	CUT, PLUG, AND ABANDONMENT OF MAINS	10-01-2002
02521	GATE VALVES	10-01-2002
02527	POLYURETHANE COATINGS ON STEEL OR DUCTILE IRON PIPE	10-01-2002
02528	POLYETHYLENE WRAP	10-01-2002
02531	GRAVITY SANITARY SEWERS	10-01-2002
02581	STREET LIGHTING CONDUIT	10-01-2002
02611	REINFORCED CONCRETE PIPE	10-01-2002
02631S	Storm Sewers	02-05-2003
02631	STORM SEWERS	10-01-2002
02632	CAST-IN-PLACE INLETS, HEADWALLS,	

AND WINGWALLS..... 10-01-2002
02633 PRECAST CONCRETE INLETS, HEADWALLS,
AND WINGWALLS 10-01-2002
02711 HOT MIX ASPHALT BASE COURSE 10-01-2002
02712 CEMENT STABILIZED BASE COURSE.....10-01-2002
02713 RECYCLED CRUSHED CONCRETE BASE COURSE.....10-01-2002
02714 FLEXIBLE BASE COURSE FOR TEMPORARY ROADS,
DETOURS, SHOULDERS, AND DRIVEWAYS 10-01-2002
02741S Asphaltic Contrete Pavement (Milling Existing Pavement)... .....1 page CMI
02741 ASPHALTIC CONCRETE PAVEMENT 10-01-2002
02742 PRIME COAT..... 10-01-2002
02743 TACK COAT 10-01-2002
02751 CONCRETE PAVING.....10-01-2002
02752 CONCRETE PAVEMENT JOINTS.....10-01-2002
02753 CONCRETE PAVEMENT CURING 10-01-2002
02761 COLORED CONCRETE FOR MEDIANS AND SIDEWALKS 10-01-2002
02762 BLAST CLEANING OF PAVEMENT..... 10-01-2002
02767 THERMOPLASTIC PAVEMENT MARKINGS 10-01-2002
02768 Paint Bridge Columns……. COH
02771 CURB, CURB AND GUTTER, AND HEADERS 10-01-2002
02772 CONCRETE MEDIANS AND DIRECTIONAL ISLANDS..... 10-01-2002
02775 CONCRETE SIDEWALKS..... 10-01-2002
02911 TOPSOIL..... 10-01-2002
02951 PAVEMENT REPAIR AND RESURFACING 10-01-2002
02983 REMOVAL AND RESTORATION OF BRICK PAVED STREETS ..10-01-2002

DIVISION 3 - CONCRETE
03315 CONCRETE FOR UTILITY CONSTRUCTION.....10-01-2002

DIVISION 4 - MORTAR
04061 MORTAR..... 10-01-2002
04210 BRICK MASONARY FOR UTILITY CONSTRUCTION 10-01-2002

DIVISION 9 - PAINT
09000 PAINT FOR COLUMNS..... 10-01-2002

DIVISION 16 – ELECTRICAL
SEE PLANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete manholes for sanitary sewers and storm sewers, including box sewers.

B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for manholes is on a unit price basis for each manhole installed.

2. Payment for Type C manhole with BB inlet top is on a unit price basis for each.

3. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

C. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

D. ASTM C 923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

E. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Non shrink).

F. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3).

G. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe, and Fittings.

H. ASTM D 2996 - Standard Specification for Filament-wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

I. ASTM D 2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

J. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed design mix and test data for each type and strength of concrete.

C. Submit manufacturer's data and details of following items for approval:

1. Frames, grates, rings, and covers.

2. Materials to be used in fabricating drop connections.

3. Materials to be used for pipe connections at manhole walls.

4. Materials to be used for stubs and stub plugs.

5. Plugs to be used for sanitary sewer hydrostatic testing.

6. Installation instructions for forms.

PART 2 PRODUCTS

2.01 CONCRETE

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Provide Class A concrete with minimum compressive strength of 4000 psi unless otherwise indicated on Drawings.

2.02 REINFORCING STEEL

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

2.03 MORTAR

A. Conform to requirements of Section 04061 - Mortar

2.04 MISCELLANEOUS METALS

A. Provide cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.05 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.06 PIPE CONNECTIONS

A. Sanitary Sewers.

1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:

   a. External clamps: Type 304 stainless steel

   b. Internal, expandable clamps on Standard manholes: Type 304 stainless steel, 11 gauge minimum

   c. Internal, expandable clamps on corrosion-resistant manholes:

      (1) Type 316 stainless steel, 11 gauge minimum

      (2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to A WWA C 213

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene waterstop meeting physical property requirements of ASTM C 923, such as Pres-Seal WS Series, or approved equal.

B. Storm Sewers: Use non-shrink grout for storm sewer pipe connections to concrete manholes, unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Water Lines

1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Pres-Seal, Thunderline, Link-Seals, or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.07 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P 201, or approved equal.

B. Provide external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

C. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.08 CORROSION-RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on the Drawings, provide one of the following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections

2. Precast base sections lined with PVC and fiberglass manhole sections and cone sections in accordance with Section 02083 - Fiberglass Manholes

2.09 BACKFILL MATERIALS

A. Conform to the requirements of Section 02317 - Excavation and Backfill for Utilities.

2.10 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based non-shrink grout requiring only addition of water.

B. Provide grout meeting requirements of ASTM C 1107 and having minimum 28-day compressive strength of 7000 psi.

2.11 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament-wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.

2. Joints and Fittings: Provide epoxy- bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Use Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B flange bolts.

4. Coating: Provide 2-component, aliphatic polyurethane coating, using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Provide Amershield, Tnemec 74, or approved equal. Project Manager selects color from manufacturer's standard colors.

2.12 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of

Occupational Safety and Health Standards (OSFIA), U.S. Department of Labor except where shown on Drawings.

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.

2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.

3. Fiberglass: Premium type polyester resin, reinforced with fiberglass: constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Determine if subgrade, when scarified and reeompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density cannot be reached, moisture condition subgrade until that density is reached or treat as an unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.02 MANHOLES

A. Construct manholes to dimensions shown on Drawings. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

C. Cast manhole foundations and walls monolithically. Use cold joint with approved water stop when manhole flow line depth exceeds 12 feet. No other joints will be allowed unless shown on Drawings. Wrap cold joints with external sealing material, minimum 6-inch with.

D. For concrete containing micro silica admixtures, place, finish, and cure concrete for manholes following procedures in Section 03315 - Concrete for Utility Construction

E. Top of manhole elevations shown on Drawings are approximate, based on current pavement and natural ground conditions as determined from elevations measured on 50-foot spacing.

No additional payment will be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

3.03 PIPE CONNECTIONS

A. Install approved resilient connectors at each pipe entering and exiting water line and sanitary-sewer manholes in accordance with manufacturer's instructions.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetrations both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on interior or exterior of manhole. When necessary, fill space with compressible material to ensure resilient connector will maintain full flexibility where evidence of reduced flexibility is encountered.

D. Where new manhole is to be constructed on existing sewer, a rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe spring line using adhesive recommended and supplied by waterstop manufacturer.

E. Do not construct joints on sanitary sewer pipe within wall sections of manholes. Use approved connection material.

F. Construct pipe stubs with resilient connectors for future connections at locations and with material indicated on Drawings. Install approved stub plugs at interior of manhole.

G. Test connection for watertight seal before backfilling.

3.04 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1 inch per foot minimum: 1 1/2 inch per foot maximum.

2. Depth of bench to invert:

   a. Pipes smaller than 15 inches: one-half of largest pipe diameter

   b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter

   c. Pipes larger than 24 inches: equal to largest pipe diameter

3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with Class A concrete if not integral with manhole base. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.05 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement-stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.

B. Install connection when sewer line enters manhole higher than 24 inches above invert of manhole.

3.06 STUBS FOR FUTURE CONNECTIONS

A. In manholes where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.07 ADJUSTMENT RINGS AND FRAME

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces to be joined with non-shrink grout. Set cast iron frame on adjustment ring in a bed of approved sealant material. Install a sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame, and ring and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. Encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded comer around perimeter.

3.08 BACKFILL

A. After concrete obtains adequate strength, place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 -Excavation and Backfill for Utilities. Use embedment zone backfill material for adjacent utilities, as shown in City of Houston Standard Details over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to spring line of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - Topsoil. Seed in accordance with Section 02921 - Hydro-mulch Seeding, or sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 FIELD QUALITY CONTROL

A. Conduct leakage testing of Sanitary Sewer manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.10 PROTECTION

A. Protect manholes from damage until subsequent work has been accepted. Repair or replace damaged elements of manholes at no additional cost to City.

END OF SECTION

Section 02082

PRECAST CONCRETE MANHOLES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in Drawings.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for normal depth manholes, up to 8 feet deep, is on a unit price basis for each manhole installed. Manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.

2. Payment for shallow depth manholes is on a unit price basis for each manhole installed. Shallow manholes have a depth of 5 feet or less measured from top of cover to sewer invert

3. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than 8 feet. Sewer manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.

4. Payment for normal depth corrosion resistant manholes is on a unit price basis for each manhole installed

5. Payment for standard manhole drops is on a unit price basis for each drop installed. Standard manhole drops include both internal and external drops.

6. Payment for watertight manholes, including external vent pipe is on a unit price basis for each.

7. Payment for air-release manhole with valves and fittings installed is on a unit price basis for each manhole with air-release valves and fittings installed.

8. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.

9. Pay estimates for partial payments will be made as measured above according to the following schedule for sanitary sewer manholes:

   a. Estimate for 90 percent payment will be authorized when the manhole is completely installed and surrounding soil backfilled

   b. Estimate for 100 percent payment will be authorized when manhole has been tested as specified in Section 02533 - Acceptance Testing for Sanitary Sewers

10. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM C 270 - Standard Specification for Mortar for Unit Masonry

E. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

G. ASTM C 923 - Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes

H. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

I. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)

J. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

K. ASTM D 2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

L. ASTM D 2997 - Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

M. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

N. American Association of State Highway and Transportation Officials (AASHTO)

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.

3. Frames, grates, rings, and covers

4. Materials to be used in fabricating drop connections

5. Materials to be used for pipe connections at manhole walls

6. Materials to be used for stubs and stub plugs, if required

7. Materials and procedures for corrosion-resistant liner and coatings, if required.

8. Plugs to be used for sanitary sewer hydrostatic testing

9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches

C. Seal submittal drawings by Professional Engineer registered in State of Texas.

PART 2 P R O D U C T S

2.01 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide tops to support HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Project Manager.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.

1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs

2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections

3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf

4. Internal liquid pressure based on unit weight of 63 pcf

5. Dead load of manhole sections fully supported by transition and base slabs

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:

1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.

2. Wall loading conditions:

a. Saturated soil pressure acting on empty manhole

b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure

3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater

G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

2.02 CONCRETE

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally

formed with manhole base, with minimum compressive strength of 4000 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Section 02321 - Cement Stabilized Sand.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.03 REINFORCING STEEL

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

2.04 MORTAR

A. Conform to requirements of Section 04061 - Mortar.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings and Covers.

2.06 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.07 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.

1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:

a. External clamps: Type 304 stainless steel

b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.

c. Internal, expandable clamps on corrosion-resistant manholes:

1) Type 316 stainless steel, 11 gauge minimum

2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:

1. Provide watertight connections in accordance with ASTM C 23.

C. Water Lines

1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.08 SEALANT MATERIALS

A. Approved products in accordance with Section 01630 - Product Substitution Procedures.

B. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.

C. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

D. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.09 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on Drawings, provide one of following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections in accordance with Section 02427 - Plastic Liner for Large-Diameter Concrete Sewers and Structures.

2. Precast base sections, as specified above, lined with PVC or equal and fiberglass manholes in accordance with Section 02083 - Fiberglass Manholes.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.

2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.l, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.

4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by Project Manager from manufacturer's standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.

2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.

3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

B. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.02 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.03 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Section 02321 - Cement Stabilized Sand.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24- inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

3.04 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer’s recommendations.

E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: “Press-Wedge,” “Res-Seal,” “Thunderline Link-Seals,” or approved equal. See

Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

E. Test connection for watertight seal before backfilling.

3.06 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum

2. Depth of bench to invert:

   a. Pipes smaller than 15 inches: one-half of largest pipe diameter

   b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter

   c. Pipes larger than 24 inches: equal to largest pipe diameter

3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.07 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.

B. Install drop connection when sewer line enters manhole higher than 24 inches above invert of manhole.

3.08 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.09 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - Topsoil. Seed in accordance with Section 02921 - Hydromulch Seeding. When shown on Drawings, sod disturbed areas in accordance with Section 02922 - Sodding.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to City.

END OF SECTION

Section 02082 S

PRECAST CONCRETE MANHOLES

The following supplements modify Specification Section 02082 - Precast Concrete Manholes Standard Specification and Details. Where a portion of the Specification or Detail is modified or deleted by this Supplementary Specification, the unaltered portions of the Specification shall remain in effect.

1.02 MEASUREMENT AND PAYMENT:

1. Delete the last sentence of Paragraph A.1 and A.3 and replace with the following:

   "Manholes for water lines are measured from top of cover to inside base."

2. Delete Paragraph A.7.

3.10 BACKFILL: Delete paragraph A and replace with the following paragraph A:

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with the requirements of Section 02317 - Excavation and Backfill for Utilities.

B DETAIL 2082-02: Delete sentence Number 9 under NOTES.

C DETAIL 2082-03: Delete sentence Number 10 under NOTES.

D DETAIL 2082-08: Delete sentence Number 3 under NOTES.

END OF SUPPLEMENT

Section 02084

FRAMES, GRATES, RINGS, AND COVERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.

2. Payment to rack over existing manhole is on a unit price basis for each manhole.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges

B. ASTM A 48 - Standard Specification for Gray Iron Castings

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. AWS - D 12.1 Welding Reinforcing Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City of Houston details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 P R O D U C T S

2.01 CASTINGS

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.

B. Use clean castings capable of withstanding application of AASHTO M306- 40,000 pound proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.

D. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

2.02 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

2.03 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

2.04 FINISH

A. Unless otherwise specified, uncoated coat iron.

2.05 FABRICATED RING GRATES

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.06 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming Section 2.01.

B. One piece casting with dimensions to fit frame and cover.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Houston standard detail, “Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch”. Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION

Section 02086

ADJUSTING MANHOLES, INLETS, AND VALVE BOXES TO GRADE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for adjusting inlets and valve boxes to grade for new construction under this Section. Include payment in unit price for related item.

2. Payment for adjusting existing manhole and frame and cover to new grade is on a unit price basis for each manhole and frame and cover.

3. Payment for adjusting existing utility structures to grade is on unit price basis for each:

a. Inlet adjusted

b. Valve box adjusted

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.01 CONCRETE MATERIALS

A. Provide concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Section 02082 - Precast Concrete Manholes.

C. Provide mortar conforming to requirements of Section 04061 - Mortar.

2.02 CAST-IRON MATERIALS

A. Provide cast-iron materials conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.03 PIPING MATERIALS

A. For riser pipes and fittings, refer to Sections 02501 - Ductile-iron Pipe and Fittings through 02528 - Polyethylene Wrap.

2.04 MASONRY MATERIALS FOR STORM SEWER MANHOLES AND INLETS

A. Provide brick masonry units conforming to the requirements of Section 04210 – Brick Masonry for Utility Construction.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Project Manger.

3.02 ESTABLISHING GRADE

A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.

3.03 ADJUSTING MANHOLES AND INLETS

A. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in the following Sections:

1. Section 02081 - Cast-In-Place Concrete Manholes
2. Section 02082 - Precast Concrete Manholes
3. Section 02083 - Fiberglass Manholes
4. Section 02087 - Brick Manholes for Storm Sewers
5. Section 02632 - Cast-In-Place Inlets, Headwalls and Wingwalls
6. Section 02633 - Precast Concrete, Inlets, Headwalls and Wingwalls

B. Salvage and reuse cast-iron frame and cover or grate.

C. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.

D. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manger's approval.

3.04 ADJUSTING VALVE BOXES

A. Salvage and reuse valve box and surrounding concrete block as approved by Project Manger. No separate pay.

B. Remove and replace 6 inch ductile iron riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade.

C. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6 inches telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.

D. After valve box has been set, aligned, and adjusted so that top lid is level with final grade.

3.05 BACKFILL AND GRADING

A. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Section 02316 - Excavation and Backfill for Structures.

B. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.

C. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - Topsoil. Provide seeding in accordance with Section 02921 - Hydro-mulch Seeding, or if sodding in accordance with Section 02922 - Sodding.

END OF SECTION

Section 02087

BRICK MANHOLE FOR STORM SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Brick masonry Work in utility construction for permanent or temporary installation of storm water manholes or vaults.

B. Brick masonry in repair and rehabilitation of storm water lines and associated structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for brick manholes is on a unit price basis for each manhole installed.

2. No payment will be made for brick masonry work for repair and rehabilitation of storm water lines. Include payment in unit price for applicable utility structure section.

3. Refer to Section 01270 - Measurement and Payment for Unit Price Procedures.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m^3)).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certifications required by Section 04061 - Mortar.

C. Submit certifications required by Section 04210 - Brick Masonry Utility Construction.

1.05 HANDLING AND STORAGE

A. Handle and store brick to prevent damage.

B. Store brick and mortar mix off ground and dry. Cover mortar mix to protect from weather.

PART 2 P R O D U C T S

2.01 BRICK MASONRY UNITS

A. Manhole bricks not exposed to flow.

1. Clay and shale brick masonry units conforming to requirements of Section 04210 - Brick Masonry for Utility Construction.

2. Concrete brick masonry units conforming to requirements of Section 04210 - Brick Masonry for Utility Construction.

B. Sewer brick. Clay and shale brick masonry units conforming to requirements of Section 04210 - Brick Masonry for Utility Construction.

2.02 MORTAR

A. Conform to requirements of Section 04061 - Mortar.

2.03 CONCRETE AND REINFORCING STEEL

A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

B. Provide Class A concrete with minimum compressive strength of 4000 psi unless otherwise indicated on Drawings.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to be 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When it cannot be compacted to that density, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.02 MANHOLES

A. Construct manholes to dimensions shown on Drawings. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manger for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24- inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

C. Construct manhole on concrete slab in accordance with requirements of Section 04210 - Brick Masonry for Utility Construction.

3.03 PIPE CONNECTIONS

A. Use non-shrink grout to seal pipe connections to manholes unless otherwise shown on Drawings.

3.04 FRAME AND COVER

A. Install frame and cover in accordance with Section 02084 - Frame, Grates, Rings, and Covers.

3.05 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02316 - Excavation and Backfill for Structures. Use embedment zone backfill material for adjacent utilities, as shown in City of Houston Standard Details over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill in accordance with Section 03315 - Concrete for Utility Construction.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - Topsoil. Seed in accordance with Section 02921 - Hydromulch Seeding, or sod disturbed areas in accordance with Section 02922 - Sodding.

3.06 FIELD QUALITY CONTROL

A. Visually inspect manhole for leakage.

3.07 PROTECTION

A. Protect manholes from damage until subsequent work has been accepted. Repair or replace damaged elements of manholes at no additional cost to City.

END OF SECTION

Section 02221

REMOVING EXISTING PAVEMENTS AND STRUCTURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, brick pavement and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.

C. Removing pipe culverts, sewers, and sewer leads.

D. Removing existing inlets and manholes.

E. Removing and disposing of pre-stressed concrete beams and drill shafts.

F. Removing miscellaneous structures of concrete or masonry.

G. Removing existing bridge.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removing and disposing of asphaltic surfacing with or without base, regardless of thickness encountered, is on square yard basis measured between lips of gutters.

2. Payment for removing and disposing of reinforced concrete pavement, with or without asphalt overlay, regardless of its thickness, is on square yard basis measured from back- to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.

3. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on square yard basis.

4. Payment for removing and disposing of concrete sidewalks and driveways is on square yard basis.

5. Payment for removing asphaltic surface course only is on a square yard basis paid under item description "Asphalt Surface Mill." This includes removal of existing surface to pavement base.

6. Payment for removing and disposing of miscellaneous concrete and masonry is on cubic yard basis of structure in place.

7. Payment for removing and disposing of pipe culverts, sewers, and sewer leads is on linear foot basis for each diameter and each material type of pipe removed.

8. Payment for removing and disposing of existing inlets is on unit price basis for each inlet removed.

9. Payment for removing and disposing of prestressed concrete piles and drill shafts is on linear foot basis.

10. Payment for removing and disposing of existing bridge, including piles and abutments to

minimum of 4 feet below ground level, is on a lump sum basis.

11. Payment for removing and disposing of existing manholes is on unit price basis for each manhole removed.

12. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Include cost of such work in unit prices for items listed in bid form requiring saw cutting.

13. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for Contractor's convenience.

    a. For utility installations: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings. Limits of measurement will be as shown on Street Cut Pavement Replacement Rules.

14. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Obtain advance approval from Project Manager for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Adjacent public and private property.

2. Trees, plants, and other landscape features designated to remain.

3. Utilities designated to remain.

4. Pavement and utility structures designated to remain.

5. Bench marks, monuments, and existing structures designated to remain.

3.03 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to minimum depth of 2 inches.

D. When street and driveway saw cut location is greater than one-half of pavement lane width, remove pavement for full lane width or to nearest longitudinal joint as directed by Project Manager.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install 8-inch-thick masonry plug in pipe end prior to backfill in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.05 DISPOSAL

A. Inlet frames, grates, and plates; and manhole frames and covers, may remain City property. Disposal shall be in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove from site, debris resulting from work under this section in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02222

ABANDONMENT OF SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Abandonment in place of existing sewers, junction structures, manholes, and force mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for grout fill and abandonment of existing sewers, including boxes and elliptical shaped sewers, is on linear foot basis for each diameter of sewer being abandoned.

Measurement will be along centerline of sewer from centerline to centerline of manholes.

2. Payment for grout fill and abandonment of sewer manholes or junction structure is by each manhole or junction structure abandoned in conformance with this Section.

3. Payment will be full compensation for all material, equipment, and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, PVC pipes and incidentals.

4. No separate payment will be made for plugging and abandoning sewer force mains. Include cost of such abandonment in related work.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

6. Acceptability of grout material is based on achieving average strength within range of 75 to 150 psi as defined in Paragraph 2.01B.1. Grout that is out of range after placement may be accepted with price adjustment of 1.0 percent price deduction for each psi average compressive strength below 75 psi and 0.5 percent price deduction for each psi average compressive strength above 150 psi, as applicable to material volume represented by test series. Shrinkage in grout material placements shall be remedied by Contractor according to Paragraph 3.04H without additional compensation.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Abandonment. Sewer abandonment consists of demolition and removal of portion of manholes existing within specified depth of surface, and abandonment in place of sewer lines and manholes as specified in this Section.

B. Flowable Fill. Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range.

C. Ballast. Large aggregate either replaced with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.

D. Backgrouting. Secondary stage pressure grouting to ensure that voids have been filled within abandoned sewer. Backgrouting will only be required at critical locations indicated on Drawings or if there is evidence of incomplete flowable fill placements.

1.04 REFERENCE STANDARDS

A. ASTM C 150 - Standard Specification for Portland cement.

B. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.

C. ASTM C 618 - Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for

use as Mineral Admixture in Portland Cement Concrete.

D. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.

E. ASTM C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Replaced Aggregate Concrete in the Laboratory.

F. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

G. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Flowable fill mix design report:

1. Flowable fill type and production method. Describe if fill will be mixed to final proportions and consistency in batch plant or if constituents will be added in transit mixer at placement location.

2. Use of ballast. Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.

3. Aggregate gradation of fill. Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.

4. Fill mix constituents and proportions including materials by weight and volume, and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.

5. Fill densities and viscosities, including wet density at point of placement.

6. Initial time of set.

7. Bleeding and shrinkage.

8. Compressive strength.

C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.

D. Experience record for proposed crew, showing minimum of 100 cubic yards of flowable fill placed using proposed or similar equipment and methods.

E. At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of work.

PART 2 P R O D U C T S

2.01 FLOWABLE FILL

A. Design Mix Criteria. Provide design of one or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.05B in mix design report including following:

1. Cement: ASTM C 150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.

2. Fly ash: ASTM C 618 Class C or F. Volume and weight per cubic yard of fill. Provide minimum Fly ash content of 200 pounds per cubic yard.

3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.

4. Aggregate gradation: 100 percent passing 3/8-inch sieve and not more than 10 percent passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes 3/8-inch, Nos. 4, 8, 16, 30, 50, 100, and 200. Do not deviate from pilot gradation by more than plus or minus 10 percentage points for any sieve for production material.

5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, add at least 30 percent of natural aggregate to provide workability.

6. Admixtures: Use admixtures meeting ASTM C 494 and ASTM C 1017 as needed to improve pumpability, to control time of set, and reduce bleeding.

7. Fluidifier: Use fluidifier meeting ASTM C 937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.

8. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.

B. Flowable Fill Requirements

1. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report.

2. Placement characteristics: self-leveling.

3. Shrinkage characteristics: non-shrink.

4. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C 940.

5. Minimum wet density: 90 pounds per cubic foot.

2.02 BALLAST

A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24 inches. Maximum dimension

shall not be more than 20 percent of minimum dimension of space to be filled.

B. Ballast Composition: Free of regulated waste material.

2.03 PLUGS FOR FORCE MAINS

A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C 1107, Grade B or C.

B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Have fill mix design reports and other submittals required by Paragraph 1.05 accepted by Project Manager prior to start of placement. Notify Project Manager at least 24 hours in advance of grouting with flowable fill.

B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.

C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project, and report them to Project Manager. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume. Dispose of waste material in compliance with Section 01576 - Waste Material Disposal.

E. Remove free water prior to starting fill placement.

3.02 EQUIPMENT

A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.

B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

3.03 DEMOLITION OF SEWER MANHOLES, PIPELINE STRUCTURES, AND FORCE MAINS PRIOR TO ABANDONMENT

A. Remove manhole frames and covers and castings from other existing pipeline structures. Deliver castings to nearest City of Houston quadrant maintenance facility for future use. Alternatively, salvaged castings may be used upon approval by Project Manager, for constructing new manholes on this project.

B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar

corbel and chimney, or other pipeline structure, to minimum depth of 4 feet below finished grade. Structure may be removed to greater depth, but not deeper than 18 inches above crown of abandoned sewer.

C. When adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.

D. Excavate overburden from force mains to be abandoned at locations indicated on Drawings, conforming to Section 02317 - Excavation and Backfill for Utilities. Cut existing force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove force main piping material remaining outside of segment to be abandoned.

3.04 INSTALLATION

A. Abandon sewer lines by completely filling sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.

B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.

C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.

D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.

E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sewer from downstream end, to discharge at upstream end.

G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.

H. Remediate placement of flowable fill which does not fill voids in sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface. Pressure grout shall conform to Section 02431 - Tunnel Grout.

I. Plug each end of force main being bandoned.

J. Force main abandonment

1. Clean inside surface of force main at least 12 inches from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.

2. When using grout plug, place temporary plug or bulkhead approximately 12 inches inside pipe. Fill pipe end completely with dry-pack grout mixture.

3. When using manufactured plug or cap, install fitting as recommended by manufacture's instructions, to form water tight seal.

K. Backfill to surface, above pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with Section 02317 - Excavation and Backfill for Utilities.

L. Collect and dispose of excess flowable fill material and other debris in accordance with Section 01576 - Waste Material Disposal.

3.05 FIELD QUALITY CONTROL

A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.

B. Check flow characteristics and workability of fill as placement proceeds.

C. Obtain at least three test cylinders for each placement area for determination of 56-day compressive strength and bleeding. Acceptance of placement will be based on average strength of three tests.

D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.

3.06 PROTECTION OF PERSONS AND PROPERTY

A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.

B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

END OF SECTION

Section 02233

CLEARING AND GRUBBING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removing surface debris and rubbish.

B. Clearing site of plant life and grass.

C. Removing trees and shrubs.

D. Removing root system of trees and shrubs.

E. Fence removal.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for clearing and grubbing is on per acre basis.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate clearing work with utility companies.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Living trees located 3 feet or more outside of intersection of side slopes and original ground line.

2. Plants other than trees and landscape features designated to remain.

3. Utilities designated to remain.

4. Bench marks, monuments, and existing structures designated to remain.

3.03 CLEARING

A. Remove stumps, main root ball, and root system to:

1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.

2. Depth of 24 inches below finished surface of required cross section for other areas.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse.

3.04 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

Section 02315

ROADWAY EXCAVATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Excavation and compaction of materials for roadways.

B. Excavation and compaction of materials for roadside ditches.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for roadway excavation is on cubic yard basis.

2. No payment will be made for material excavated under the following conditions:

a. More than 2 feet outside of vertical planes behind back of curbs

b. For portion within limits of trench for utilities 24-inch and greater constructed by open-cut methods

c. As indicated otherwise on Drawings.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44 ft-lbf/ft^3).

B. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

C. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 3017 - Standard Test Method for Water content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Provide topsoil conforming to requirements of Section 02911 - Topsoil.

B. Provide backfill which is excavated material, graded free of roots, lumps greater than 6 inches, rocks larger than 3 inches, organic material, and debris.

C. Provide structural backfill which is select material meeting following requirements:

1. Plasticity index: not less than 12 nor more than 20.

2. Maximum liquid limit: 45

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Identify required lines, levels, and datum. Coordinate with Section 01725 - Field Surveying.

B. Identify and flag surface and aerial utilities.

C. Notify utility companies to remove or relocate utilities.

D. Identify, stake, and flag known utility locations below grade. Make temporary or permanent relocation of underground pipes, ducts, or utilities where indicated on Drawings.

E. Upon discovery of unknown or badly deteriorated utilities, or concealed conditions, discontinue work. Notify Project Manager and obtain instructions before proceeding in such areas.

F. Obtain approval of top soil quality before excavating and stockpiling.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Trees, shrubs, lawns, existing structures, and other features outside of grading limits.

2. Utilities either above or below grade, which are to remain.

3.03 TOPSOIL REMOVAL

A. Strip off topsoil from area to be excavated to minimum depth of 6 inches, unless indicated otherwise on Drawings.

B. Stockpile topsoil in designated location for reuse. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.04 SOIL EXCAVATION

A. Excavate to lines and grades shown on Drawings.

B. Remove unsuitable material not meeting specifications, Backfill with embankment materials and compact to requirements of Section 02330 - Embankment.

C. Record location and plug and fill inactive water and oil wells. Conform to Texas Department of Health, Texas Natural Resource Conservation Commission, and Texas Railroad Commission requirements. Notify Project Manager prior to plugging wells.

D. At intersections, grade back at minimum slope of one inch per foot. Produce smooth riding junction with intersecting street. Maintain proper drainage.

E. When area is inadvertently over excavated, fill area in accordance with requirements of Section 02330 - Embankment at no additional cost to City.

F. Remove material not qualified for use and excess soil not being reused from site in accordance with requirements of Section 01576 - Waste Material Disposal.

3.05 COMPACTION

A. Maintain optimum moisture content of subgrade to attain required density.

B. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:

1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.

2. Other areas: Minimum density of 90 percent of maximum dry density.

3.06 TOLERANCES

A. Top of Compacted Surface: Plus or minus 1/2 inch in cross section, or in 16-foot length.

3.07 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Test and analysis of soil materials will be performed in accordance with ASTM D 4318, ASTM D 2216, and ASTM D 698.

C. Compaction testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017.

D. A minimum of three tests will be taken for each 1000 linear feet per lane of roadway.

E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no additional cost to City.

3.08 PROTECTION

A. Prevent erosion at all times. Maintain ditches and cut temporary swales to allow natural drainage in order to avoid damage to roadway. Do not allow water to pond.

B. Distribute construction traffic evenly over compacted areas, where practical, to aid in obtaining uniform compaction. Protect exposed areas having high moisture content from wheel loads that cause rutting.

C. Maintain excavation and embankment areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density.

END OF SECTION

Section 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Excavation, backfilling, and compaction of backfill for structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for structural excavation and backfill under this Section. Include payment in unit price or lump sum for construction of structures.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.

C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.

C. ASTM D 2922 - Standard Test Methods for Density of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 3017 - Standard Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

E. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

F. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

G. TxDOT Tex-110-E - Particle Size Analysis of Soils.

H. Federal Regulations, 29 CFR, Part 1926, Standards - Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit work plan for excavation and backfill for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to excavation and backfill activities. Use descriptions, with supporting illustrations, sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Drawings.

C. Submit excavation safety system plan.

1. Submit excavation safety system plan in accordance with applicable OSHA requirements for excavations.

2. Submit excavation safety system plan in accordance with requirements of Section 02260 - Trench Safety System, for excavations that fall under State and Federal trench safety laws.

D. Submit ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

E. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and

gradients.

1.06 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving requirements of this Specification.

B. Use equipment which will produce degree of compaction specified. Compact backfill within 3 feet of walls with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to depth of fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

A. Use backfill materials conforming to classifications and product descriptions of Section 02320 - Utility Backfill Materials. Use classification or product description for backfill applications as shown on Drawings and as specified.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Conduct an inspection to determine condition of existing structures and other permanent installations.

B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where affected by Work, and is considered hazardous to traffic movements.

C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 02260 - Trench Safety Systems.

D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.02 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.

E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to City.

3.03 EXCAVATION

A. Perform excavation work so that underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Project Manager.

B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding in such areas.

C. Immediately notify agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.

D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.

E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.

F. Conduct hauling operations so that trucks and other vehicles do not create dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner such that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.

G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by Work.

H. Provide sheeting, shoring, and bracing where required to safely complete Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect Work and adjacent structures or improvements. Use sheeting, shoring, and bracing to protect workmen and public conforming to requirements of Section 02260 - Trench Safety Systems.

I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, cement stabilized sand, or other material approved by Project Manager and compact to 95 percent standard density.

J. After completion of structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Project Manager in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to Work and adjacent structures or improvements.

K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or other material approved by Project Manager and compact to 95 percent standard density.

3.04 HANDLING EXCAVATED MATERIALS

A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at sufficient distance from excavation to prevent slides or cave-ins.

B. Provide additional backfill material in accordance with requirements of Section 02319 - Borrow, if adequate quantities of suitable material are not available from excavation and trenching operations at site.

3.05 DEWATERING

A. Provide ground water control per Section 01578 - Control of Ground Water and Surface Water.

B. Keep ground water surface elevation minimum of 2 feet below bottom of foundation base.

C. Maintain ground water control as directed by Section 01578 - Control of Ground Water and Surface Water and until structure is sufficiently complete to provide required weight to resist hydrostatic uplift with minimum safety factor of 1.2.

3.06 FOUNDATION EXCAVATION

A. Notify Project Manager at least 48 hours prior to planned completion of foundation excavations. Do not place foundation base until excavation is accepted by Project Manager.

B. Excavate to elevations shown on Drawings, as needed to provide space for foundation base, forming level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or material as directed by Project Manager. Prior to placing material over it, recompact subgrade where indicated on Drawings, scarifying as needed, to 95 percent of maximum Standard Dry Density according to ASTM D 698. If specified level of compaction cannot be achieved, moisture condition subgrade and recompact until 95 percent is achieved over-excavate to provide minimum layer of 24 inches of foundation backfill material, or other means acceptable to Project Manager.

C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by Project Manager.

D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

E. Remove soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to required subgrade, and replace with foundation backfill material, as directed by Project Manager, at no additional cost to City.

F. Place foundation base, or foundation backfill material where needed, over subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with seal slab or cement-stabilized sand.

G. Use filter fabric as specified in Section 02621 - Geotextile to separate crushed aggregate, and other free draining Class I materials from native soils or select material backfill. Overlap fabric minimum of 12 inches beyond where another material stops contact with soil.

H. Place crushed aggregate and other Class I materials, in uniform layers of 8-inch maximum thickness. Perform compaction by means of at least two passes of vibratory compactor.

3.07 FOUNDATION BASE.

A. Place foundation base after subgrade is properly prepared, including placement of foundation backfill where needed. Use foundation base consisting of 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, seal slab with minimum thickness of 4 inches may be placed. Extend foundation base minimum of 12 inches beyond edge of structure foundation, unless shown otherwise on Drawings.

B. Where foundation base and foundation backfill are of same material, both can be placed in one operation.

3.08 BACKFILL

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Remove forms, lumber, trash and debris from structures. Use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified.

B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that concrete has reached minimum of 85 percent of specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until slab or intermediate walls have been placed and concrete has attained sufficient strength.

C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.

D. Maintain backfill material at no less than 2 percent below nor more than 2 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698 below paved areas. Compact fill to at least 95 percent around structures below unpaved areas.

E. Where backfill is placed against sloped excavation surface, run compaction equipment across boundary of cut slope and backfill to form compacted slope surface for placement of next layer of backfill.

F. Place backfill using cement stabilized sand in accordance with Section 02321 – Cement Stabilized Sand.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Tests will be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity.

C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions:

1. Minimum of one test for every 50 to 100 cubic yards of compacted backfill material as directed by Project Manager.

2. A minimum of three density tests for each full work shift.

3. Density tests will be performed in all placement areas.

4. Number of tests will be increased when inspection determines that soil types or moisture contents are not uniform or when compacting effort is variable and not considered sufficient to attain uniform density.

5. Identify elevation of test with respect to natural ground.

6. Record approximate depth of lift tested.

D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Perform additional moisture-density relationship test once a month or whenever there is noticeable change in material gradation or plasticity.

E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02316 S

EXCAVATION AND BACKFILL FOR STRUCTURES

The following supplements modify Section 02316 - Excavation and Backfill for Structures Standard Specification Where a portion of the Specification is modified or deleted by this Supplementary Specification, the unaltered portions of the Specification shall remain in effect.

1.03 DEFINITIONS: Delete paragraph D and replace with the following paragraph D.

D. Backfill: Material meeting specified quality requirements, placed and compacted under controlled conditions around structures.

3.08 BACKFILL: Delete paragraph A and replace with the following paragraph A.

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Remove forms, lumber, trash and debris from structures.

1. Unless otherwise shown on Drawings, for structures under pavement or within one foot back of curb, use cement stabilized sand up to pavement base or subgrade.

2. Unless otherwise shown on Drawings, for structures not under pavement, use cement stabilized sand to within 2 feet of final grade. Use Random backfill of suitable material for top two feet.

END OF SUPPLEMENT

Section 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

2. When Project Manager directs Contractor to over excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6" Over excavation of Trench Bottom.

a. No payment will be paid if Project Manager does not direct Contractor to over excavate trench bottom.

b. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground Water and Surface Water.

3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost for unit price for work requiring critical location.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

   a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.

   b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 02260 - Trench Safety Systems.

S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave- in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions

and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

1.04 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Particle Size Analysis of Soils.

L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit planned typical method of excavation, backfill placement and compaction including:

1. Trench widths.

2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.

3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.

E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

F. Submit 11 inch by 17 inch or 12 inch by 18 inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

1.07 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre- manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

C. Classification of material will be determined by Project Manager.

3.02 PREPARATION

A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - Trench Safety Systems.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground Water and Surface Water. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section

01725 - Field Surveying.

3.03 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2 feet vertically and 4 feet horizontally of proposed work.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.

2. Notify Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours notice prior to field excavation or related work.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12 inch by 18 inch copy of Drawings. For large diameter water lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

3.04 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to City.

3.05 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.).

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.

2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.

3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.

4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.

G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without

damage to trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.

5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber- tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company’s line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company’s representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy-acetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company’s representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

3.06 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.08 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6 inches with approval by Project Manager. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, if directed by Project Manager, in accordance with Paragraph 3.08B above. Removal of unstable or unsuitable material may be required if approved by Project Manager;

1. Even though Contractor has not determined material to be unsuitable, or

2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground Water and Surface Water.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.09 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:

1. Class I, II and III Embedment Materials:

   a. Maximum 6 inches compacted lift thickness.

   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.

   c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement Stabilized Sand (where required for special installations):

   a. Maximum 6 inches compacted thickness.

   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.

   c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.

3. Class I Embedment Materials.

   a. Maximum 6-inches compacted lift thickness.

   b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.

   c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.

4. Class II Embedment and Cement Stabilized Sand.

   a. Maximum 6-inches compacted thickness.

   b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.

   c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

K. Place trench dams in Class I embedment in line segments longer than 100 feet between

manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.10 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.

B. For water lines, backfill in trench zone, including auger pits, intermediate and site pits, with bank run sand, select fill, or random backfill material as specified in Section 02320 - Utility Backfill materials.

C. For sewer pipes, use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand for pipes of nominal sizes 36 inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42 inches in diameter and larger, under pavement or natural ground, in satisfactory soil conditions, backfill from 12 inches above top of pipe to 12 inches below pavement with suitable on-site material or select backfill. For sewer pipes 42 inches in diameter and larger, under pavement or natural ground, in unsatisfactory soil conditions, backfill from 12 inches above top of pipe to 12 inches below pavement with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement. For backfill materials reference Section 02320 - Utility Backfill Materials.

D. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.

E. When shown on Drawings, random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

F. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.

1. Class I, II, III or IV or combination thereof (Random Backfill):

   a. Maximum 9-inches compacted lift thickness.

   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

   c. Moisture content within zero percent to +5 percent of optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement-Stabilized Sand:

   a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.

   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.

c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Select Backfill:

a. Place in maximum 8-inch loose layers.

b. Compaction by equipment providing tamping or kneading impact to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

c. Moisture content within 2 percent below or 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone.

1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.

2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.

3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.

4. Moisture content as necessary to achieve density.

H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.11 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.

B. Below paved areas, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum 1 foot around walls, up to within 12 inches of pavement subgrade. Compact in accordance with Paragraph 3.10.F.2 of this Section

C. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

3.12 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to City.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Project Manager.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.

1. For open cut construction projects and auger pits: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.

2. A minimum of three density tests for each full shift of Work.

3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at same frequency as first test series, including verification tests.

8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.13 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02318

EXTRA UNIT PRICE WORK FOR EXCAVATION AND BACKFILL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Measurement and payment applicable to extra unit price work items for excavation and backfill made necessary by unusual or unforeseen circumstances encountered during utility installations.

B. Extra unit price work for excavation and backfill is paid only when authorized in advance by Project Manager.

1.02 UNIT PRICES

A. Excavation Around Obstructions: Payment for excavation around obstructions is on cubic yard basis, measured in place, without deduction for volume occupied by portions of pipes, ducts, or other structures left in place across trenches excavated under this item.

B. Extra Hand Excavation: Payment for extra hand excavation is on cubic yard basis, measured in place.

C. Extra Machine Excavation: Payment for extra machine excavation is on cubic yard basis, measured in place.

D. Extra Placement of Backfill Material: Payment for extra placement of backfill material is on cubic yard basis, measured in place, for material installed as part of Work. At discretion of Project Manager, measurement of cubic yards may be calculated from volume of Extra Hand Excavation or Extra Machine Excavation for which replacement is made, minus volume of any Extra Placement of Granular Backfill authorized in conjunction with Work.

E. Extra Placement of Granular Backfill: Payment for extra placement of granular backfill material is on cubic yard basis, measured in place.

F. No separate payment will be made for surface water control, groundwater control, or for excavation drainage. Refer to Section 01270 - Measurement and Payment for unit price procedures.

1.03 DEFINITIONS

A. Excavation Around Obstructions: Excavation necessitated by obstruction of pipes (other than service connections 3 inches in diameter or less), ducts, or other structures, not shown on Drawings, and of an unusual or unforeseen nature which interfere with installation of utility piping by normal methods of excavation or auguring.

B. Extra Hand Excavation: Excavation by manual labor made necessary by unusual or unforeseen circumstances at locations approved in advance by Project Manager.

C. Extra Machine Excavation: Excavation by machine at or near project site to perform related work not included in original project scope but added for convenience of City, as approved in advance by Project Manager.

D. Extra Replacement of Backfill Material: Handling, backfill, and compaction of excavated material authorized under extra work bid items for Extra Hand Excavation or Extra Machine Excavation. Placement and compaction shall conform to requirements specified for excavation and backfill in Division 2- Site Work.

E. Extra Placement of Granular Backfill: Hauling, placing, and compacting granular backfill materials as approved by Project Manager in conjunction with Extra Replacement of Backfill Material. Materials placed under this item shall conform to requirements for Bank Run Sand, Cement Stabilized Sand, Concrete Sand, Gem Sand, Crushed Stone, or Crushed Concrete specified for backfill material in Division 2- Site Work.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 02320

UTILITY BACKFILL MATERIALS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:

1. Concrete sand
2. Gem sand
3. Pea gravel
4. Crushed stone
5. Crushed concrete
6. Bank run sand
7. Select backfill
8. Random backfill

C. Material Handling and Quality Control Requirements.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for backfill material. Include payment in unit price for applicable utility installation.

2. Payment for backfill material, when included as separate pay item or when directed by Project Manager, is on cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings, or as directed by Project Manager.

3. Payment for backfill of authorized over-excavation is in accordance with Section 02318 - Extra Unit Price Work for Excavation and Backfill.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material:

1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.

4. Materials contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material:

1. Materials meeting specification requirements.

2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.

G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.

H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over- excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Section 02317 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

1.04 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregate.

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.

E. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Standard Test Method for Amount of Material in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. ASTM D 4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.

K. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

L. TxDOT Tex-460-A - Material Finer Than 75 Fm (No.200) Sieve In Mineral Aggregates (Decantation Test for Concrete Aggregates).

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.03, Material Testing.

D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.

E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

1.06 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.03B.

B. Verification tests of backfill materials may be performed by City in accordance with Section 01454 - Testing Laboratory Services and in accordance with Paragraph 3.03.

PART 2 P R O D U C T S

2.01 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:

1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):

   a. Plasticity index: non-plastic.

   b. Gradation: D_{60}/D_{10} - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.

2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):

   a. Plasticity index: non-plastic to 4. b. Gradations:

      1. Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.

      2. Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.

      3. Borderline gradations with dual classifications (e.g., SP-SM): amount passing

No. 200 sieve - between 5 percent and 12 percent.

3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):

   a. Plasticity index: greater than 7.

   b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.

4. Class IVA: Lean clays (CL).

   a. Plasticity Indexes:

      1. Plasticity index: greater than 7, and above A line.

      2. Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.

   b. Liquid limit: less than 50.

   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.

   d. Inorganic.

5. Class IVB: Fat clays (CH)

   a. Plasticity index: above A line.

   b. Liquid limit: 50 or greater.

   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.

   d. Inorganic.

6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

2.02 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by Project Manager. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:

   1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.

   2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.

3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Project Manager, provided that physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:

1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.

2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8”	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2”	100
3/8”	85 to 100

No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by Project Manager.

2. Non-plastic fines.

3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.

4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.

5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.

6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15"	15" - 8"	<8"
1"	95 - 100	100	-
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Section 02951 - Pavement Repair and Resurfacing, to meet plasticity criteria.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Section 02316 -

Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

K. Cement Stabilized Sand: Conform to requirements of Section 02321 - Cement Stabilized Sand.

L. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

M. Flexible Base Course Material: Conform to requirements of applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Crushed Concrete Base Course.

2.03 MATERIAL TESTING

A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:

1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.

2. Plasticity of material passing No. 40 sieve

3. Los Angeles abrasion wear of material retained on No. 4 sieve

4. Clay lumps

5. Lightweight pieces

6. Organic impurities

B. Production Testing. Provide reports to Project Manager from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.

C. Assist Project Manager in obtaining material samples for verification testing at source or at production plant.

PART 3 E X E C U T I O N

3.01 SOURCES

A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Project Manager may obtain samples for verification testing.

C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which,

after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Project Manager, expense for sampling and testing required to change to different material will be credited to City through change order.

D. Bank run sand, select backfill, and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete work from off-site sources.

E. City does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.

3.02 MATERIAL HANDLING

A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.

B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Project Manager in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

A. Quality Control

1. The Project Manager may sample and test backfill at:

   a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.

   b. On-site stockpiles.

   c. Materials placed in Work.

2. The Project Manager may re-sample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: City's testing laboratory will provide verification testing on backfill materials, as directed by Project Manager. Samples may be taken at source or at production plant, as applicable.

END OF SECTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES A. Cement stabilized sand.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring cement stabilized sand.

2. Refer to Paragraph 3.04 for material credit.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C 150 - Specification for Portland Cement.

H. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil Cement- Mixtures.

I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory

J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

K. ASTM D 2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

M. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.

N. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

1.05 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.

2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 02320 - Utility Backfill Materials, and the following requirements:

1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.

2. Deleterious materials:

a. Clay lumps, ASTM C 142 - less than 0.5 percent.

b. Lightweight pieces, ASTM C 123; less than 5.0 percent.

c. Organic impurities, ASTM C 40, color no darker than standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.03 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:

1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.

2. Complete molding of samples within 4 hours after addition of water.

3. Perform strength tests (average of two specimens) at 48 hours and 7 days.

4. Perform cement content tests on each sample.

5. Perform moisture content tests on each sample.

6. Plot average 48-hour strength vs. cement content.

7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test raw sand for following properties at point of entry into pug-mill:

1. Gradation

2. Plasticity index

3. Organic impurities

4. Clay lumps and friable particles

5. Lightweight pieces

6. Moisture content

7. Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula: f'_c% 1/2 standard deviation

PART 3 E X E C U T I O N

3.01 PLACING

A. Place sand-cement mixture in maximum 12-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content

during compaction is ±3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

3.02 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabililized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number
2. Time material was batched
3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number
8. Indication of compliance / non-compliance
9. Mixture identification
10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.03 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:

1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.

2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor s expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Project Manager, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.

G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2\,(100\text{ psi} - \text{Actual psi})}{100}$$

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to City.

END OF SECTION

CEMENT STABILIZED SAND CHART
can be viewed on the following website
https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx

STANDARD SPECIFICATION CEMENT STABILIZED SAND

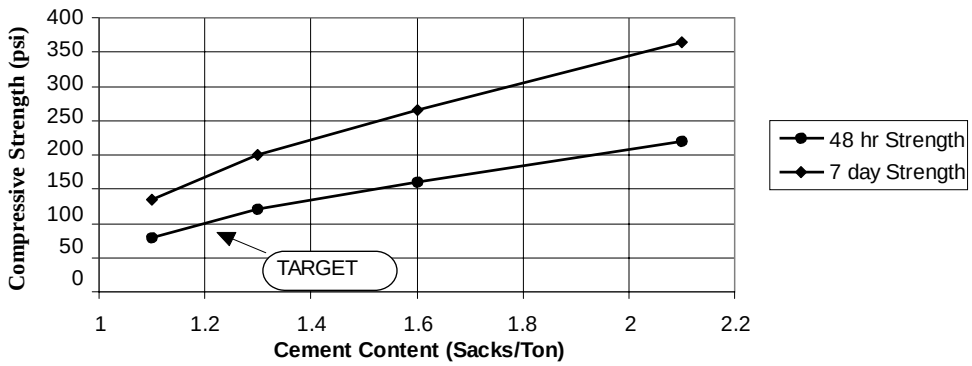
Supplier: City Stabilized Sand	**Plant No:** 1 - Main Street	**Date of Tests:** January 1, 1997

Item	Raw Sand	1.1 Sack	100 psi	1.5 Sack	2.0 Sack
Moisture Content	10.9	15.7	14.0	13.8	13.7
Cement Feed Dial Setting	--	2.25	2.5	2.75	3.75
Silo Pressure (psi)	--	4	4	4	4
Batch Time	10:00	10:10	10:15	10:20	10:25
Sample Time	--	10:10	10:15	10:20	10:25
Molding Time	--	12:30	12:45	1:00	1:15
Cement Content (sacks/ton)	--	1.1	1.3	1.6	2.1

Compressive Strength at 48 hrs. (avg of 2)	--	80	120	160	220
Compressive Strength at 7 days(avg of 2)	--	135	200	265	365

Sieve	Percent Passing	COH Spec. Section 02320
3/8 Inch	100	--
No. 16	100	--
No. 40	100	--
No. 50	99	--
No. 100	41	--
No. 200	11	0 to 15
Raw Sand Tests	**Result**	**City of Houston**
Plasticity Index	Non-Plastic	4 Maximum
Organic Impurities	Passing	No Darker Than
Clay Lumps & Friable Parts (%)	0.0	0.5 % Maximum
Lightweight Pieces (%)	0.0	5.0 % Maximum
Classification	SP-SM	SW, SP, SW-SM, SP-SM, SM

Compressive Strength vs Cement Content



Section 02336

LIME STABILIZED SUBGRADE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of lime stabilized subgrade material.

1. Application of lime slurry to subgrade.

2. Mixing, compaction, and curing of lime slurry, water, and subgrade into a stabilized foundation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Measurement and payment for lime stabilized subgrade is on a square yard basis compacted in place to proper density. Separate measurement will be made for each required thickness of subgrade course.

a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Drawings. Limits for measurement will be extended to include installed lime stabilized subgrade material that extends 2 foot beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for lime stabilized subgrade in areas beyond these limits.

b. Limits of measurement and payment shall match pavement replacement limits shown on Drawings, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager.

2. Measurement and payment for lime is by ton of 2000 pounds dry weight basis. Calculate weight of dry solids for lime slurry based on percentage by dry weight solids.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 DEFINITION

A. Moist Cure: Curing soil and lime to obtain optimum hydration.

B. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.04 REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3).

B. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

D. TxDOT Tex-101-E (Part III) - Preparation of Soil and Flexible Base Material for Testing.

E. TxDOT Tex-140-E - Measuring Thickness of Pavement Layer.

F. TxDOT Tex-600-J - Sampling and Testing Hydrated Lime, Quicklime, and Commercial Lime Slurry.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification that hydrated lime, quicklime, or commercial lime slurry complies with specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

1.06 DELIVERY, STORAGE AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

PART 2 P R O D U C T S

2.01 WATER

A. Use clean, clear water, free from oil, acids, alkali, or vegetation.

2.02 LIME

A. Type A - Hydrated Lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide as listed in chemical composition chart.

B. Type B - Commercial Lime Slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.

C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:

1. Grade DS: Pebble quicklime of gradation suitable for use in preparation of slurry for wet placing.

2. Grade S: Finely-graded quicklime for use in preparation of slurry for wet placing. Donor use grade S quicklime for dry placing.

D. Conform to the following requirements:

CHEMICAL COMPOSITION	TYPE		
	A	B	C
Active lime content, % by weight $Ca(OH)_2$+CaO	90.0 min[1]	87.0 min[2]	-
Unhydrated lime content, % by weight CaO	5.0 max	-	87.0 min
Free water content, % by weight H_2O :	5.0 max	-	-
SIZING			
Wet Sieve, as % by weight residue retained:			
No. 6	0.2 max	0.2 max[2]	8.0 max[3]
No. 30	4.0 max	4.0 max[2]	-
Dry sieve, as % by weight residue retained:			
1-inch	-	-	0.0
1/2-inch	-	-	10.0 max

Notes:
1. Maximum 5.0% by weight CaO shall be allowed in determining total active lime content.
2. Maximum solids content of slurry.
3. Total active lime content, as CaO, in material retained on No. 6 sieve shall not exceed 2.0% by weight of original Type C lime.

E. Deliver lime slurry to job site as commercial lime, or prepare at job site by using hydrated lime or quicklime. Provide slurry free of liquids other than water and of consistency that can be handled and uniformly applied without difficulty.

F. Lime containing magnesium hydroxide is prohibited.

2.03 SOIL

A. Soil to receive lime treatment may include borrow or existing subgrade material, existing pavement structure, or combination of all three. Where existing pavement or base material is encountered, pulverized or scarify material so that 100 percent of sampled material passes 2- inch sieve.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted subgrade will support imposed loads.

B. Verify subgrade lines and grades.

3.02 PREPARATION

A. Complete backfill of utilities prior to stabilization.

B. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:

1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.

2. Provide cut to depth as specified or shown in the Drawings.

C. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.

D. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by Project Manager.

E. Pulverize existing material so that 100 percent passes a 1-3/4-inch sieve.

3.03 LIME SLURRY APPLICATION

A. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on same working day.

B. Minimum lime content shall be 5 percent of dry unit weight of subgrade as determined by ASTM D 698

3.04 PRELIMINARY MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain homogeneous friable mixture free of clods and lumps.

B. Shape mixed subgrade to final lines and grades.

C. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.05C can be met during preliminary mixing:

1. Seal subgrade as precaution against heavy rainfall by rolling lightly with light pneumatic rollers.

2. Cure soil lime material for 24 to 72 hours or as required obtaining optimum hydration keep subgrade moist during cure.

3.05 FINAL MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.

B. Add water to bring moisture content of soil mixture to optimum or above.

C. Mix and pulverize until all material passes 13/4-inch sieve; minimum of 85 percent, excluding non-slacking fractions, passes 3/4-inch sieve; and minimum of 60 percent excluding non-slacking fractions passes No. 4 sieve. Test according to TxDOT Tex-101-E, Part III using dry method.

D. Shape mixed subgrade to final lines and grades.

E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.06 COMPACTION

A. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D 698 on material sample from roadway after final mix with lime.

B. Start compaction immediately after final mixing.

C. Spread and compact in two or more equal layers where total compacted thickness is greater than equipment manufacturer's recommended range of mixing and compaction.

D. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.

E. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.

F. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D 698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Drawings:

G. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

3.07 CURING

A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.08 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16-foot length.

C. Depth of lime stabilization shall be plus or minus one inch of specified depth for each 1000- foot roadway section.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Test soils, lime, and mixtures as follows:

1. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318, using the wet preparation method.

2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.

3. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.

4. Moisture-density relationship will be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, moist preparation Method.

C. In-place depth will be evaluated for each 1000-foot roadway section and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 1000-foot section, 3 phenolphthalein tests will be performed. Average stabilization depth for 1000-foot section will be based on average depth for three tests.

D. Perform compaction testing in accordance with ASTM D 2922. Three tests will be performed for each 1000-foot roadway section.

E. Pulverization analysis will be performed as required by Paragraph 3.05C on material sampled during mixing of each production area. Three tests will be performed per 1000-foot roadway section or a minimum of once daily.

3.10 REWORK OF FAILED SECTIONS

A. Rework sections that do not meet specified thickness.

B. Perform the following steps when more than 72 hours have lapsed since completion of compaction.

1. Moist cure for minimum of 3 days after compaction to required density.

2. Add lime at rate of 25 percent of specified rate at no additional cost to City.

3. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.11 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION

Section 02338

PORTLAND CEMENT STABILIZED SUBGRADE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of portland cement stabilized natural subgrade material.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for Portland cement stabilized subgrade is on a square yard basis compacted in place to proper density. Separate measurement will be made for each different required thickness of subgrade course.

a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Drawings. Limits for measurement will be extended to include installed Portland cement stabilized subgrade material that extends 2 foot beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for Portland cement stabilized subgrade in areas beyond these limits.

b. Limits of measurement and payment shall match pavement replacement limits shown on Drawings, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager

2. Payment for Portland cement is by ton of 2000 pounds dry-weight basis.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 150 - Standard Specification for Portland Cement.

B. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil-Cement-Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44 ft-lbf/ft^3).

D. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification that Portland cement complies with these specifications.

PART 2 P R O D U C T S

2.01 WATER

A. Water: clean, clear and free from oil, acids, alkali, or organic matter.

2.02 PORTLAND CEMENT

A. ASTM C 150 Type I; bulk or sacked.

2.03 SOIL

A. Provide soil consisting of approved material free from vegetation or other objectionable matter encountered in existing roadbed.

2.04 TESTS

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318.

C. Soil will be evaluated to establish ratio of cement to soil to obtain desired stability. Normal range is 6 percent to 10 percent by weight.

D. The percentage of moisture in soil, at time of cement application, will be determined by ASTM D 558. Moisture will not be allowed to exceed quantity that will permit uniform, complete mixture of soil and cement during dry mixing operations nor specified optimum moisture content for soil cement mixture, as determined.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify subgrade lines and grades are correct.

3.02 EQUIPMENT

A. Apply Portland cement treatment with machine or combination of machines and auxiliary equipment to produce specified results. Mixing may be accomplished by multiple-pass traveling mixing plant or single-pass traveling mixing plant. Provide sufficient equipment to enable continuous prosecution of work

3.03 PREPARATION

A. Backfill for utilities below future grade.

B. Verify subgrade is firm and able to support, without displacement, construction equipment at specified density. Correct soft or yielding subgrade and stabilize by scarifying and aerating or by adding cement and compacting to uniform stability.

C. Grade, shape, and compact, as required, to allow construction of Portland cement treatment for in-place materials to lines, grades, thickness, and typical cross section shown on Drawings. Remove unsuitable soil or material and replace with acceptable material.

D. Pulverize soil so that at completion of moist-mixing, 100 percent by dry weight passes 1-inch sieve, and minimum of 80 percent passes No. 4 sieve, exclusive of gravel or stone retained on these sieves. Pulverize existing bituminous wearing surfaces so that 100 percent will pass 2-inch sieve.

3.04 MIXING

A. Do not place and mix cement when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Spread cement uniformly on soil at rate specified by laboratory. When bulk cement spreader is used, position it by string lines or other approved method to ensure uniform distribution of cement. Apply cement only to area where operations can be continuous and completed in daylight, within 1 hour of application. Amount of moisture in soil at time of cement placement shall not exceed quantity that will permit uniform mixture of soil and cement during dry mixing operations. Do not exceed specified optimum moisture content for soil cement mixture.

C. Do not allow equipment other than that used in spreading and mixing, to pass over freshly spread cement until it is mixed with soil.

D. Dry mix cement with soil after cement application. Continue mixing until cement has been sufficiently blended with soil to prevent formation of cement balls when water is applied. Mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

E. Immediately after dry mixing is complete, uniformly apply water as necessary and incorporate it into mixture. Pressurized equipment must provide adequate supply to ensure continuous application of required amount of water to sections being processed within 3 hours of cement application. Ensure proper moisture distribution at all times. After last increment of water has been added, continue mixing until thorough and uniform mix has been obtained.

F. Ensure percentage of moisture in mixture, based on dry weights, is within 2 percentage points of specified optimum moisture content prior to compaction. When uncompacted soil cement mixture is wetted by rain indicating that average moisture content exceeds tolerance given at time of final compaction, reconstruct entire section in accordance with this Section at no additional cost to City.

3.05 COMPACTION

A. Prior to beginning compaction, ensure mixture is in loose condition for its full depth. Uniformly compact the loose mixture to specified density, lines, and grades.

B. After soil and cement mixture is compacted, apply water uniformly as needed and mix thoroughly. Then reshape surface to required lines, grades, and cross section and lightly scarify to loosen imprints left by compacting or shaping equipment.

C. Roll resulting surface with pneumatic-tired roller and "skin" surface with power grader.

Thoroughly compact mixture with pneumatic roller, adding small increments of moisture, as needed. When aggregate larger than No. 4 sieve is present in mixture, make one complete coverage of section with flat-wheel roller immediately after skinning operation. When approved by Project Manager, surface finishing methods may be varied from this procedure, provided dense uniform surface, free of surface compaction planes, is produced. Maintain moisture content of surface material at its specified optimum during finishing operations. Compact and finish surface within period not to exceed 2 hours, to produce smooth, closely knit surface, free of cracks, ridges, or loose material, conforming to crown, grade, and line shown on Drawings within period not to exceed 2-hours.

3.06 CONSTRUCTION JOINTS

A. At end of each day's construction, form straight transverse construction joint by cutting back into total width of completed work to form true 2-inch depth vertical face free of loose and shattered material. Construct cement treatment for large wide areas in series of parallel lanes of convenient length and width approved in advance by Project Manager.

3.07 CURING

A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. When open, restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base and surface within 14 days after final mixing and compaction, unless prior approval is obtained from Project Manager.

3.08 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16-foot length.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. In-place density will be determined in accordance with ASTM D 2922 or ASTM D 698. Minimum of three tests will be taken for each 1000 feet per lane of roadway or 500 square yards of embankment.

3.10 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION

MILLING EXISTING PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Milling of existing asphalt surfacing from an underlying Portland cement concrete pavement or existing asphalt base.

1.02 UNIT PRICES

A. Measurement for milling existing asphalt pavement is on a square yard basis.

B. Refer to Section 01025 - Measurement and Payment for unit price procedures.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 GENERAL

A. All asphalt material shall be removed, leaving a uniform surface of Portland cement concrete or existing base.

3.02 PREPARATION

A. Prior to and after the milling process, all dirt and foreign material shall be removed from the pavement surface by power brooming or other approved methods.

3.03 EQUIPMENT

A. The existing material to be removed shall be milled by means of rotary cutting blades, until it is broken into particles small enough to be removed.

3.04 WASTE MATERIAL DISPOSAL

A. Care shall be taken to prevent millings from entering inlets and storm sewers. All material entering inlet and storm sewer shall be cleaned by Contractor.

B. Dispose of waste material in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02501

DUCTILE IRON PIPE AND FITTINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Ductile iron pipe and fittings for water lines, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for ductile iron pipe and fittings under this Section, with the exception of extra fittings in place. Include cost in unit prices for work as specified in the following Sections, as applicable:

a. Section 02511 - Water lines

b. Section 02531 - Gravity Sanitary Sewers

c. Section 02532 - Sanitary Sewage Force Mains

d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Extra Ductile Iron Compact Fittings in Place shall be for additional fittings required to complete job. This is not to exclude extension of pipe across driveway or intersection for purpose of terminating line in more advantageous position. This determination shall be at discretion of Project Manager. This bid item includes additional fittings as may be necessary to complete job in conformance with intent of Drawings.

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.4 (AWWA C 104) - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, for Water.

B. ANSI A 21.10 (AWWA C 110) - Standard for Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in.

C. ANSI A 21.11 (AWWA C 111) - Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

D. ANSI A 21.15 (AWWA C 115) - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

E. ANSI A21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey iron Fittings for Water Supply Service.

F. ANSI A 21.50 (AWWA C 150) - Standard for Thickness Design of Ductile-Iron Pipe.

G. ANSI A 21.51 (AWWA C 151) - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.

H. ANSI A 21.53 (AWWA C 153) - Standard for Ductile Iron Compact Fittings, 3 inches through 24

inches and 54 inches through 64 inches for Water Service.

I. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

J. ASTM D 1248 - Standard Specification Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.

K. ASTM F 477 - Elastomeric Seals (gaskets) for Joining Plastic Pipe.

L. ASTM G 62 - Standard Test Methods for Holiday Detection in Pipeline Coatings.

M. AWWA C 102 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

N. AWWA C 300 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and other Liquids.

O. AWWA C 600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

P. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.

Q. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

R. American Association of State Highway Transportation Officials (AASHTO).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. For pipes 16 inches and greater submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing the following:

1. Manufacturer's pipe design calculations.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (*.PDF).

3. Calculations and limits of thrust restraint.

4. Class and length of joint.

C. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

D. Submit certifications that pipe joints have been tested and meet requirements of ANSI A 21.11.

E. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded

epoxy coatings or linings.

PART 2 P R O D U C T S

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: ANSI A 21.15, ANSI A 21.50 or ANSI A 21.51; bear mark of Underwriters' Laboratories approval; minimum thickness Class 51 for water lines and thickness Class 52 for sanitary sewers, or as shown on Drawings. Provide minimum thickness Class 53 for flanged pipe.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

C. Modify pipe for cathodic protection in accordance with Section 16640 - Cathodic Protection for Pipelines. In lieu of furnishing ductile iron pipe with cathodic protection system, furnish ductile iron pipe with polyethylene encasement, provided the following criteria is met:

1. Provide minimum thickness class.

2. Provide polyethylene encasement material and installation in accordance with AWWA C105, and backfill as specified. Minimum of two complete wraps of 8-mil-thick polyethylene.

3. Use polyethylene encasement for open cut installations only. For augered sections or sections installed inside a casing, provide coating in accordance with paragraph 2.05 D.1.

4. Adhere to other requirements specified herein (e.g., insulation kits, etc.).

D. For use of pressure class pipe for water lines, design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Drawings. Design pipes with Marston's earth loads for a transition width trench for zero to 16 feet of cover. Use Marston's earth loads for a trench width of O.D. (of pipe) + 4 feet for pipe greater than 16 feet of cover. Use Marston's equations for a trench condition in both open-cut and tunnel applications. Design for most critical groundwater level condition. Pipe design conditions:

1. Working pressure = 100 psi.

2. Hydrostatic field test pressure = 150 psi.

3. Maximum pressure due to surge = 150 psi.

4. Minimum Pressure due to surge = -5 psi.

5. Design tensile stress due to surge or hydrostatic test pressure: No greater than 50% minimum yield.

6. Design bending stress due to combined earth loads and surge or hydrostatic test pressure: No greater than 48,000 psi.

7. Unit weight of fill $ 120 pcf.

8. Deflection lag factor (D_l) = 1.2.

9. Bedding constant (K) = 0.1.

10. Moment coefficient = 0.16.

11. Fully saturated soil conditions hw=h=depth of cover above top of pipe.

E. Hydrostatic Test of Pipe: AWWA C 151, Section 5.2.1, at point of manufacture. Hold test for a minimum 2 minutes for thorough inspection of pipe. Repair or reject pipe revealing leaks or cracks.

F. Pipe Manufacturer for large diameter water lines: Minimum of 5 years of successful pipe installations in continuous service. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

Line Diameter	Required Bends*
20 and 24 inches	Four 45E bends per 5,000 LF of water line
> 24 inches	Four 22.5E bends per 10,000 LF of water line
*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer's option (i.e. two 22.5E bends are equivalent to one 45E bend) and will be counted as one fitting.	

Manufacturer or supplier must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of Project Manager where unforeseen obstacles are encountered during construction. These fittings are in addition to any fittings called out in construction documents and must be available at all times.

G. Provide flange adapter with insulating kit as required when connecting new piping to existing piping and piping of different materials, unless otherwise approved by Project Manager.

H. Clearly mark pipe section to show location and thickness/pressure class color coded.

2.02 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.16 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, conform to requirements of AWWA C111; provide minimum 304 stainless steel for restraint joints.

B. Where required by Drawings, provide approved restrained joints for buried service.

C. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 02515 - Hydrostatic Testing of Pipelines or Section 02532 - Sanitary Sewer Force Mains, as applicable. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.

E. Bond rubber gasketed joints to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings.

F. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer for pipe joints or restraint joints. Submit details of other methods of providing curves and bends for consideration by Project Manager. When other methods are deemed satisfactory, install at no additional cost to City.

2.03 GASKETS

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material in accordance with ANSI A21.11 or ASTM F 477 (One Bolt only); for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. For pipes to be installed in potentially contaminated areas, see Specification Section 02105 - Sampling and Analysis in PPCA.

2.04 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they connect to.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11; pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water lines: ANSI A 21.53; 4 inch through 12 inch diameter fusion bonded epoxy-lined or cement mortar lining.

2.05 COATINGS AND LININGS

A. Water line Interiors: ANSI A21.4, cement lined with seal coat; ANSI A 21.16 fusion bonded epoxy coating for interior; comply with NSF 61.

B. Sanitary Sewer and Force Main Interiors:

1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.

2. Liner thickness: Nominal 40 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6-inches back from end.

3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.

4. Acceptable Lining Materials:

a. Provide approved virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage; heat bonded to interior surface of pipe and fittings.

b. Ceramic Epoxy – Protecto 401.

C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Exterior:

1. Water Lines

a. Auger Holes: Conform to requirements of Section 02527 – Polyurethane Coatings on Steel or Ductile Iron Pipe.

b. Above Ground (or Exposed): Conform to requirements of Section 02502 - Steel Pipe and Fittings, Paragraph 2.03.

c. Tunnel, Casing or Direct Bury: Conform to requirements of Paragraph 2.05E.

2. Sanitary Sewers: Prime coat and outside asphaltic coating conforming to ANSI A21.10, ANSI A21.15, or ANSI A21.51 for pipe and fittings in open cut excavation and in casings.

E. Polyethylene Wrap: For buried pipes not cathodically protected, provide polyethylene wrap unless otherwise specified or shown. Conform to requirements of Section 02528 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer for maximum resistance to the contaminants identified in the Phase II Environmental Site Assessment Report.

H. For water lines cathodically protected, supply ductile iron pipe with either tape coatings or some other bonded dielectric coating as specified in Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.

2.06 MANUFACTURERS

A. Use pre-approved manufacturers listed in City of Houston approved products.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Conform to installation requirements of Sections 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, 02532 - Sanitary Sewer Force Mains 02561 - Storm Sewers and 02553 - Point Repairs and Obstruction Removal, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in double polyethylene wrap, unless cathodic protection is provided.

Do not use polyethylene wrap with a cathodic protection system.

D. Holiday Testing.

1. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

2. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

3.02 FIELD REPAIR OF COATINGS

A. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

B. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

END OF SECTION

Section 02502

STEEL PIPE AND FITTINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Steel pipe and fittings for water lines for aerial crossings, aboveground piping, and encasement sleeves. Do not bury steel pipe, unless it is large diameter water line.

B. Specifications identify requirements for small-diameter less than or equal to 20 inches.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for steel pipe and fittings under this Section. Refer to Section 02511 - Water Lines for measurement and payment.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.

B. ASME B 16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.

C. ASTM A 36 - Standard Specification for Carbon Structural Steel.

D. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded

and Seamless.

E. ASTM A 105 - Standard Specification for Carbon Steel Pipe Forgings for Piping Applications

F. ASTM A 106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

G. ASTM A 135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.

H. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).

I. ASTM A 1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

J. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

K. AWWA C 200 - Standard for Steel Water Pipe 6 in. and Larger.

L. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

M. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

N. AWWA C 210 - Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

P. AWWA M 11 – Steel Pipe – A Guide for Design and Installation.

O. SSPC Good Painting Practice, Volume 1.

P. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.

Q. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.

R. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

S. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.

T. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures. For aerial crossings and above ground piping, include lay schedule of new pipe and fittings indicating alignment and grade, laying dimensions, lining and coating systems, proposed welding procedures, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings.

B. Submit manufacturer's certifications that pipe and fittings are new and unused.

C. Submit manufacturer's certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200.

D. Submit manufacturer's affidavits that coatings and linings comply with applicable requirements of this Section and:

1. Polyurethane coatings were applied in strict accordance with manufacturer's recommendation and allowed to cure at temperature 5 degrees above dew point.

2. Linings were applied and allowed to cure at temperature above 32 F.

E. Submit certification from NACE Certified Coatings Inspector, having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected were properly repaired.

1.05 QUALITY CONTROL

A. Prior to start of work, provide proof of certification of qualification for welders employed for type of work, procedures and positions involved. Provide welder qualifications in accordance with AWWA C 206.

B. Shop-applied coatings and linings; provide services of an independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector verifying compliance with same requirements specified in Paragraph 3.02.

C. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.

D. Final Inspection:

1. Before shipment, inspect each finished pipe, fitting, special and accessory for markings, metal thickness, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness.

2. Inspect for coating placement and defects. Test exterior coating for holidays.

a. Inspect linings for thickness, pitting, scarring, and adhesion.

E. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.

PART 2 P R O D U C T S

2.01 STEEL PIPE

A. Manufacture pipe with nominal diameter 20 inches and less but more than 2 inches to conform to ASTM A106 or A 53 Grade B, standard weight.

B. Provide steel pipe and encasement sleeves designed and manufactured in conformance with AWWA C 200 and AWWA M 11 except as modified herein. Steel to be minimum of ASTM A 36, ASTM A 1011 Grade 36, ASTM A 53 Grade B, ASTM A 135 Grade B, or ASTM A 139 Grade B.

C. Minimum Allowable Steel-Wall Thickness:

CARRIER PIPE			
Nom. Pipe Size (In.)	Min. Wall		Approx. Wt. Per L. F. Uncoated (Lb.)
	O.D. (In.)	Thick. (In.)	
4	4.50	0.250	11.35
6	6.625	0.280	18.97
8	8.625	0.322	28.55
10	10.75	0.365	40.48
12	12.75	0.375	49.56
16	16.00	0.375	62.58
20	20.00	0.375	78.60

Notes Carrier Pipe:

1. Review pipe and fitting design for conditions exceeding those specified herein.

2. Provide pipe with wall thickness of no less than listed in table above.

MINIMUM DIAMETER CASING PIPE (ENCASEMENT SLEEVES)			
Corresp. Casing Pipe Size (In.)	Min. Wall		Approx. Wt. Per L. F. Uncoated (Lb.)
	O.D. (In.)	Thick. (In.)	
8	8.625	0.219	19.64
10	10.75	0.219	24.60
12	12.75	0.219	29.28
16	16.00	0.219	36.86
18	18.00	0.25	47.39
20	20.00	0.250	52.73
24	24.00	0.250	63.41

Notes for Casing Pipe:

1. Provide casing pipe with wall thickness of no less than listed in table above.

2. Casing pipe: AWWA C 200 new uncoated welded steel.

3. Verify casing diameter required with dimensions of casing spacer.

D. Provide pipe sections in lengths of no less than 16 feet except as required for special sections, as and no greater than 40 feet.

E. Provide short sections of steel pipe no less than 4 feet in length unless indicated on Drawings or specifically permitted by Project Manager.

F. Fittings: Factory forged for sizes 4 inches through 20 inches; long radius bends; beveled ends for

field butt welding; wall thickness equal to or greater than pipe to which fitting is to be welded unless otherwise shown on Drawings.

G. Joints:

1. Standard field joint for steel pipe and encasement sleeve: AWWA C 206. Single- welded, butt joint.

2. Provide mechanically coupled or flanged joints for valves and fittings, as shown on Drawings. Flanges: AWWA C 207, Class D; same diameter and drilling as Class 125 cast iron flanges ASME B 16.1. Maintain electrically isolated flanged joints between steel and cast iron by using epoxy-coated bolts, nuts, washers and insulating type gasket.

3. Elbows to be standard weight seamless elbows per ASTM A106, Grade A or B.

4. Flanges for pipe 20 inches in diameter and smaller shall be ANSI 150 lb. flat face, slip on or weld neck flanges, meeting ASTM A105 requirements. Where flanges are to join to valves with raised face flanges, use ANSI 150 lb. raised flange.

5. Provide same coating for exposed portions of nuts and bolts as flanges which they secure.

H. Fabricate flanges with over-size bolt holes, with flanges drilled in pairs, to accommodate insulating sleeves.

2.02 INTERNAL LINING SYSTEMS FOR STEEL PIPE, ALL INSTALLATIONS

A. Supply steel pipe with epoxy lining, capable of conveying water at temperatures not greater than 140 degrees F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61 and certification to be from organization accredited by ANSI. Unless otherwise noted, coat exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, etc., with epoxy lining, as specified.

B. Epoxy Lining AWWA C 210, White, or approved equal for shop and field joint applied, except as modified in this Section. Provide material from same manufacturer. For Pipe larger than 2 inches in diameter protect interior surface with liquid two-part chemically cured epoxy primer specified for interior surfaces.

Surface Preparation 2.0 to 3.0 mils surface profile	SSPC-5 (64) White Blast Clean
Prime Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy - Buff, or approved equal
Intermediate Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy - Buff, or approved equal
Finish Coat 4.0 to 6.0 mils DFT	NSF Certified Epoxy - White, or approved equal

1. Total allowable dry film thickness for system:

a. Minimum: 12.0 mils.

b. Maximum: 18.0 mils.

c. Minimum field adhesion: 700 psi.

2. Dry film thicknesses for approved alternate products in accordance with product manufacturer's recommendations.

3. Lining system may consist of three or more coats of same approved alternate epoxy lining without use of separate primer.

2.03 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVEGROUND AND IN VAULTS (EXPOSED)

A. Provide 3-coat-epoxy/polyurethane coating system as designated below. Provide material from same manufacturer.

Surface Preparation 2.0 to 3.0 mils surface profile	SSPC SP 10 Near White Blast Clean
Prime Coat 4.0 to 6.0 mils DFT	Inhibitive Epoxy Primer, or approved equal
Intermediate Coat 4.0 to 6.0 mils DFT	Chemical Resistant Epoxy, or approved equal
Finish Coat 1.5 to 2.5 mils DFT	Polyurethane, or approved equal Barr Blue color as approved by Project Manager

B. Total Allowable Dry Film Thickness (DFT) for System:

1. Minimum: 9.5 mils.

2. Maximum: 12.5 mils.

C. Clean bare pipe free from mud, mill lacquer, oil, grease, or other contaminant. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use only approved safety solvents which do not leave residue. Use preheating to remove oil, grease, mill scale, water, and ice provided pipe is preheated in uniform manner to avoid distortion.

D. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges, presence of metallic defects may be cause for rejection of pipe.

PART 3 E X E C U T I O N

3.01 PIPING INSTALLATION

A. Conform to applicable provisions of Section 02511 - Water lines, except as modified in this Section.

B. Comply with the following:

1. Bedding and Backfilling: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

2. For pipes with coating: Do not roll or drag pipe on ground, move pipe in such a manner as not to damage pipe or coating. Carefully inspect pipe for abrasions and repair damaged coating before pipe is installed.

C. Static Electricity:

1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.

2. Electrically test where required after installation is complete.

3.02 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE GROUND AND IN VAULTS (EXPOSED) AND EPOXY INTERNAL LINING SYSTEM.

A. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.

B. Workmanship:

1. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.

2. Paint Application Procedures: SSPC Good Painting Practices, Volume 1.

C. Surface Preparation:

1. Prepare surfaces for painting by using abrasive blasting.

2. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.

3. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.

4. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by grinding to 1/4-inch minimum radius.

5. Abrasive Material:

a. Blast only as much steel as can be coated same day of blasting.

b. Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to job site in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.

c. After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Tex Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Project Manager.

d. Do not blast if metal surface may become wet before priming commences, or when metal surface is less than 5 degrees F above dew point.

6. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis 1.

7. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing ¾-inch by-4 inch piece of clear Scotch type tape on blasted surface, then removing and placing tape on 3x5 white index card. Reclean areas exhibiting dust or residue.

D. Coating and Lining Application:

1. Environmental Conditions: Do not apply coatings or linings when metal temperature is less than 50 degrees F; when ambient temperature is less than 5 degrees F above dew point; when expected weather conditions are such that ambient temperature will drop below 40 degrees F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels.

2. Application Procedures:

a. Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.

b. Thin materials only with manufacturers recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.

c. Discard catalyzed materials remaining at end of day.

3. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.

4. Cure a minimum of 24 hours at 77 degrees F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coatings are applied, provide forced air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

E. Testing of Coatings and Linings:

1. Inspect pipe for holidays and damage to coating:

a. If test indicates no holidays and coating is damaged, remove damaged layers of coating and repair in accordance with coating manufacturer’s recommendations.

2. Perform holiday test in accordance with NACE Standard Recommended Practice, RPO 188-90, Discontinuity (Holiday) Testing of Protective Coatings.

3. Begin testing of completed coating after coating has sufficiently cured, usually one to 5 days. Consult coating manufacturer for specific curing schedule.

4. Perform adhesion test on pipe in accordance with ASTM D 4541.

5. For coating thickness of 20 mils or less, test with wet sponge low-voltage holiday detector. For coating thickness in excess of 20 mils, test with high-voltage holiday detector. Perform electrical holiday test with 60-cycle current audio detector. Select test voltage as suggested in table below.

MINIMUM VOLTAGES FOR HIGH VOLTAGE SPARK TESTING

Total Dry Film Thickness (mils)	Suggested Inspection (V)
20 to 40	3,000
41 to 55	4,000
56 to 80	6,000

3.03 JOINTS AND JOINTING

A. Welded Joints:

1. Conform to requirements of Section 02511 - Water Lines.

2. Field weld to be full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.

3. City will employ an independent certified testing laboratory to perform weld acceptance tests on welded joints. Testing Laboratory will test by X-ray methods for butt welds, for 100 percent of joint welds. Project Manager has final decision as to suitability of welds tested.

B. Flanged Joints: Conform to requirements of Section 02511 - Water Lines.

C. Joint Grouting and Testing: Conform to requirements of Section 02511 - Water Lines.

3.04 COATINGS AND LININGS INSPECTION RESPONSIBILITIES

A. Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. Project Manager is responsible for quality assurance and reserves the right to inspect or acquire services of an independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at all phases of coatings and linings work, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Project Manager provides such inspection.

END OF SECTION

Section 02504

CENTRIFUGALLY CAST FIBERGLASS PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Centrifugally cast fiberglass reinforced plastic (FRP) pipe for sanitary sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for fiberglass pipe under this Section. Include cost in unit price for Work, as specified in Section 02531 - Gravity Sanitary Sewers, Section 02532 - Sanitary Sewage Force Mains, or Section 02550 - Sliplining Sanitary Sewers.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM D 3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

B. ASTM D 3681 - Method for Determining Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin Pipe in a Deflected Condition.

C. ASTM D 3754 - Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

D. ASTM D 4161 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

E. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Provide sufficient data for the Project Manager to properly evaluate the pipe.

C. Product data submittals shall include the following, as a minimum:

1. Details of the proposed pipe.

2. Properties and strengths of the pipe.

3. Details of pipe joint.

4. Pipe design analysis.

5. Instruction on storage, handling, transporting, and installation.

6. Standard catalog sheets.

D. Test Reports: Provide test reports upon request, certifying that the pipe has been tested in accordance with and exceeds minimum requirements of ASTM D 3262 and ASTM D 3681.

PART 2 P R O D U C T S

2.01 MANUFACTURERS

A. Provide centrifugally cast fiberglass pipe manufactured by Hobas Pipe USA, Inc.

2.02 MATERIALS

A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been collected from applications of a composite material of similar construction and composition as the proposed product.

B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade glass filaments with binder and sizing compatible with impregnating resins.

C. Fillers: Silica sand or other suitable materials may be used.

D. Additives: Resin additives, such as pigments, dyes, and other coloring agents, if used, shall in no way be detrimental to the performance of the product nor shall they impair visual inspection of the finished products.

E. Rubber Gaskets: Supply from an approved gasket manufacturer in accordance with ASTM F 477, when no contaminant is identified and suitable for the service intended. Gaskets shall either be affixed to the pipe by means of a suitable adhesive or shall be installed in such a manner so as to prevent the gasket from rolling out of the pre-cut groove in the pipe or sleeve coupling. When pipe is to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, provide the following gasket materials for the noted contaminants.

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by the pipe manufacturer

F. The internal liner resin shall be suitable for service as sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements of ASTM D 3681.

2.03 MANUFACTURE AND CONSTRUCTION

A. Pipes

1. Furnish pipes in the diameters specified and within the tolerances specified below.

2. Manufacture pipe by the centrifugal casting process to result in a dense, nonporous, corrosion-resistant, consistent composite structure to meet the operating conditions as shown on the Drawings.

3. Do not use stiffening ribs or rings.

B. Couplings: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D 4161.

C. Fittings: Flanges, elbows, reducers, tees, and other fittings shall be capable of withstanding operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass fiber reinforced overlays.

D. Manhole Connections: Provide a water stop flange (wall pipe) for connection to manhole base or other structure in accordance with Section 02081 - Cast-in-Place Concrete Manholes, or Section 02082 - Precast Concrete Manholes.

E. Grout Ports: Provide grout ports in the wall of pipe when required. Provide plugs of 316 stainless steel or other corrosion-resistant material compatible with the pipe. Grout port plugs shall be designed and installed to meet the test pressure of the pipe.

2.04 DIMENSIONS

A. Diameters: The actual outside diameter of the pipes shall be in accordance with Table 3 of ASTM D 3262 for gravity sewers, or ASTM D 3754 for force mains.

B. Lengths: The pipe standard length will be approximately 20 feet. A maximum of 10 percent of the lengths, excluding special order pipes, may be supplied in random lengths.

C. Wall Thickness: The minimum average wall thickness shall be the stated design thickness. The minimum single point thickness shall not be less than 90 percent of the stated design thickness.

D. End Squareness: Pipe ends shall be square to the pipe axis.

E. Tolerance of Fittings: The tolerance of the angle of an elbow and the angle between the main and leg of a wye or tee shall be plus or minus 2 degrees. The tolerance on the laying length of a fitting shall be plus or minus 2 inches.

2.05 STIFFNESS CLASSES

A. Stiffness class of FRP pipe shall satisfy design requirements, but shall not be less than 46 psi, when used in direct bury operation; 36 psi, when installed within a primary tunnel liner.

B. Stiffness class of FRP in a pipe jacking operation shall be governed either by the ring deflection limitations or by a pipe design providing longitudinal strength required by the jacking method and shall satisfy design requirements stated below. Submit design calculations as required in Paragraph 1.04, Submittals.

1. Pipe stress calculations based on jacking loads shall be performed to conform to Section 02441 - Microtunneling and Pipe Jacked Tunnels.

2. Ring deflection calculations shall conform to design requirements of 30 TAC Chapter 317.20 pertaining to flexible pipe used in gravity sewers. The pipe deflection calculations shall ensure that predicted deflection will be less than 5 percent under long-term loading conditions (soil prism load) for the highest density of soil overburden and surcharge loads. Deflection on calculations shall be prepared using long-term (drained) values for soil parameters contained in the geotechnical investigation report for the Project, or other site-specific data obtained by the Contractor as approved by the Engineer.

2.06 TESTING

A. Pipes shall be tested in accordance with ASTM D 3262 or ASTM D 3754, as applicable, except that the factory hydrostatic pressure testing is not required.

B. Joints: Coupling joints shall be qualified per the tests of Section 7 of ASTM D 4161.

2.07 INSPECTION

A. The Project Manager shall be entitled to inspect pipes or witness the pipe manufacturing. Such inspection shall not relieve the manufacturer of the responsibilities to provide products that comply with the applicable standards and these Specifications.

B. Manufacturer's Notification: Should the Project Manager wish to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Project Manager with adequate advance notice of when and where the production of those pipes will take place.

C. Failure to Inspect: Should the Project Manager elect not to inspect the manufacturing, testing, or finished pipes, it in no way implies approval of products or tests.

2.08 PACKAGING, HANDLING, AND SHIPPING

A. Packing, handling, and shipping should be done in accordance with the manufacturer's recommendations.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Install pipe and fittings in accordance with requirements of Section 02531 - Gravity Sanitary Sewers, 02532 - Sanitary Sewage Force Mains, or Section 02550 - Sliplining Sanitary Sewers.

B. The manufacturer must supply a suitable qualified field service representative to be present periodically during the installation of pipe.

C. Pipe Bedding: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

D. Pipe Handling: Use textile slings.

E. Jointing

1. Clean ends of pipe and coupling components.

2. Check pipe ends and couplings for damage. Correct any damage found.

3. Coupling grooves must be completely free of dirt.

4. Apply joint lubricant to pipe ends and rubber seals of coupling. Use only lubricants approved by the pipe manufacturer.

5. Use suitable auxiliary equipment, such as a wire rope puller, to pull joints together.

6. Do not exceed forces recommended by the manufacturer for coupling pipe. If excessive force is required, remove coupling, determine source of problem, and correct it.

7. In the process of jointing the pipe, do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

F. If pressure grouting of the pipe is conducted as part of a pipe-jacked tunnel installation, seal the grout holes with liner resin to a thickness equal to the pipe liner thickness or with a threaded plug for that purpose.

G. Tests: Conform to requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

END OF SECTION

Section 02506

POLYVINYL CHLORIDE PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 48 inches.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for work included as specified in the following sections:

a. Section 02511 - Water Lines

b. Section 02531 - Gravity Sanitary Sewers

c. Section 02532 - Sanitary Sewer Force

Mains d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches through 48 Inches for Water.

P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.

R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.

S. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.

T. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

U. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.05 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Project Manager for review. Cost of testing paid by Contractor.

PART 2 P R O D U C T S

2.01 MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.

1. Pipe Material:

   a. DR 18: For restrained joints where shown on Drawings.

   b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.

1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.

2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:

1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.

2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.

3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

H. Do not use PVC in potentially or known contaminated areas.

I. Do not use PVC in areas exposed to direct sunlight.

2.02 WATER SERVICE PIPE

A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 14 inch through 20 inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Project Manager.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

2.03 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

WALL CONSTRUCTION	MANUFACTURER	ASTM DESIGNATION	SDR (MAX.)/ STIFFNESS	DIAMETER SIZE RANGE
Solid	J-M Pipe CertainTeed Diamond Uponor ETI North American	D3034	SDR 26 / PS	6" to 10"
		D3034	SDR 35 / PS	12" & 15"
		F679	SDR 35 / PS	18" to 27"
		AWWA C900	DR 18 / N/A	4" to 12"
		AWWA C909	DR 18 / N/A	4" to 12"
		AWWA C905	DR 18 / N/A	14" to 16"
Truss (Gasketed)	Contech	D2680	N/A /200 psi	8" to 15"
Profile	Contech A-2000	F949	N/A / 46 psi	12" to 36"
	Contech A-2026	F949	N/A / 115 psi	8" to 10"
	ETI, Ultra-Rib	F794	N/A / 46 psi	8" to 30"
	ETI, Ultra-Corr	F794	N/A / 46 psi	24" to 36"

B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Project Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D

2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.

H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.

I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

2.04 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 02532 - Sanitary Sewage Force Mains.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Section 02501 - Ductile Iron Pipe and Fittings, Paragraph 2.04, except furnish fittings with one of following approved internal linings:

1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting

2. Nominal 40 mils (35 mils minimum) polyurethane

3. Nominal 40 mils (35 mils minimum) ceramic epoxy

4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 02528 - Polyethylene Wrap.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

2.05 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 E X E C U T I O N

3.01 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer’s recommendations.

3.02 INSTALLATION

A. Conform to requirements of Section 02511 - Water Lines, Section 02531 - Gravity Sanitary Sewers, and Section 02532 - Sanitary Sewer Force Mains, as applicable.

B. Install PVC pipe in accordance with Section 02317 - Excavation and Backfill for Utilities, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:

1. Water service pipe 12 inches in diameter and smaller 4 feet of cover.

2. Water service pipe 16 inches in diameter and larger 5 feet of cover.

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.

F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.

G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

3.03 PVC RESTRAINED MECHANISM

A. Do not apply lubricant to spline or pipe or coupling spline grooves.

B. Do not use excessive force while inserting the spline through coupling.

C. Insert spline until it is fully seated around circumference of pipe.

D. Field Cutting of Pipe Ends:

1. Perform by workers certified by manufacturer.

2. Use a PVC pipe cutter and provide square ends.

3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installation of water lines.

B. Specifications identify requirements for both small diameter water lines and large diameter water lines. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water lines installed by open-cut, augered with or without casing, aerial crossing, and pipe offset section or within limits of Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation.

   a. Mains: Measure along axis of pipe and include fittings and valves. b.

      Branch Pipe: Measure from axis of water line to end of branch.

2. Payment for interconnection is on lump sum basis for each interconnection identified on Drawings. Payment will include tapping sleeve and valves piping, connections and other related work necessary for construction as shown on Drawings or specified herein.

3. Payment for removal of existing internal elliptical or dished head plug is on unit price basis for each internal elliptical or dished head plug removed. Payment will include deletion of plug, drainage or dewatering of water lines, repair of damaged linings, rechlorination and items incidental to operation.

4. Payment for plug and clamp is on a unit price basis for each size of pipe.

5. Payment for drainline connection with service manhole is on unit price basis for each drainline shown on drawings. Payment includes valve, access manhole and connection.

6. Payment for cylindrical corrosion barriers is on a unit price basis for each pipe fitting installed with one or more barriers.

7. When directed by Project Manager to install extra fittings as required to avoid unforeseen obstacles, payment will be based on the following:

   a. Each extra fitting requested by Project Manager and delivered to jobsite will be paid according to unit price for "Extra Fittings in Place."

   b. Payment will include and be full compensation for items necessary for installation and operation of water line.

8. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile – Iron Pressure Pipe and Fittings.

B. ANSI/NSF Standard 61 - Drinking Water System -Health Components.

C. ASTM A 36 - Standard Specification for Carbon Structural Steel

D. ASTM A 536 - Standard Specification for Ductile Iron Castings

E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.

G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes. H.

ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.

I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination

K. ASTM E 709 - Standard Guide for Magnetic Particle Examination

L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Photographs: Submit photographs conforming to requirements of Section 01321 - Construction Photographs prior to commencement of construction.

D. Submit videotapes conforming to requirements of Section 01323 – Construction Videotapes, if applicable.

E. Submit Lone Star notification transmittal number prior to beginning excavation.

F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:

1. Disinfection; not to exceed 4,000 linear feet per section.

2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.

3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

PART 2 P R O D U C T S

2.01 PIPE MATERIALS

A. Install pipe materials which conform to following:

1. Section 02501 - Ductile Iron Pipe and Fittings.

2. Section 02502 - Steel Pipe and Fittings. Water line piping within plant site and aerial crossings to be welded joint steel pipe with flange or approved restraint joint connections, unless otherwise shown on Drawings.

3. Section 02506 - Polyvinyl Chloride Pipe.

4. Section 02507 - Prestressed Concrete Cylinder Pipe.

5. Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.

6. Section 02613 - Bar-Wrapped Steel Cylinder Pipe.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

C. Type of pipe materials used is Contractor's option unless specifically identified on Drawings.

D. Provide minimum of 3/8 inch inside joint recess between ends of pipe in straight pipe sections.

2.02 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE

A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.

B. O-rings: Conform to National Sanitary Foundation requirements.

2.03 RESTRAINED JOINTS

A. Ductile-Iron Pipe: See Section 02501 - Ductile Iron Pipe and Fittings.

B. PVC Pipe: See Section 02506 - Polyvinyl Chloride Pipe. Perform hydrostatic testing in accordance with ASTM F 1674.

C. Prestressed Concrete Cylinder Pipe, Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.06 D).

D. Restrained Joints where required on DIP and PVC pipe:

1. Restraint devices: Manufacture of high strength ductile iron, ASTM A 536 up to 24 inches, and ASTM A 36 for sizes greater than 30 inches. Working pressure rating twice that of design test pressure.

2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

2.04 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

A. Flexible (Dresser-type) Couplings.

1. Install where shown on Drawings or where allowed by Project Manager for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.

2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.

3. Provide approved flanged adapter couplings for steel pipe

4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of approved coal tar coating.

B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on Drawings.

1. Body and Flap: ASTM A 126-B cast iron.

2. Seats: ASTM B 21-CA482 or ASTM B 301-CA145 bronze.

3. Resilient Seat:

4. Hinge Arms: ASTM B 584-CA865 high tensile bronze.

5. Hinge pins: ASTM B 98-CA655 silicon bronze.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.

C. Lay pipe to lines and grades shown on Drawings.

D. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes or separation of four feet minimum from force mains as specified in this Section in all directions unless special design is provided on Drawings.

E. Where above clearances cannot be attained, and special design has not been provided on

Drawings, obtain direction from Project Manager before proceeding with construction.

F. Inform Project Manager if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Project Manager.

G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing 2 pipe installation crews shall be permitted, unless otherwise approved by Project Manager.

H. City of Houston Utility Operations Division will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.

I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.

J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Project Manager.

3.02 HANDLING, CLEANING AND INSPECTION

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.

2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.

4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.

5. Use precautions to prevent injury to pipe, protective linings and coatings.

a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.

b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.

c. Do not lift pipe using hooks at each end of pipe.

d. Do not place debris, tools, clothing, or other materials on pipe.

6. Repair damage to pipe or protective lining and coating before final acceptance.

7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than 6 inches, measured within 15 degrees of line parallel to pipe longitudinal axis of finished pipe, except:

a. In surface laitance of centrifugally cast concrete.

b. In sections of pipe with steel reinforcing collars or wrappers.

c. Within 12 inches of pipe ends.

8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.03 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities and Section 02447 - Augering Pipe and Conduit.

B. Bedding: Use bedding materials in conformance with Section 02320 - Utility Backfill Materials.

C. Backfill: Use bank run sand or earth or native soil as specified in Section 02320 - Utility Backfill Materials. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.

E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.04 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Project Manager. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.05 PIPING INSTALLATION

A. General Requirements:

1. Lay pipe in subgrade free of water.

2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.

3. Properly form bedding to fully support bell without wedging or blocking up bell.

4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of Project Manager prior to skipping any portion of Work.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Section 02317 - Excavation and Backfill for Utilities for additional requirements at critical locations.

E. Laying Large Diameter Water Line

1. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.

2. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Project Manager. No additional payment will be made for higher class of pipe or improved bedding.

3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.

4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.

5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.

6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.

F. Perform following additional procedures when working on plant sites.

1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Project Manager and Water Production personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Project Manager agrees key personnel, equipment and materials are on hand to complete Work.

2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.

3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Project Manager and City's Utility Maintenance Division operator is present to observe.

4. Coordinate with City's Water Production Division operators to obtain reduction in operating pressures prior to performing connections to existing piping.

5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Project Manager.

6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Section 01110 - Summary of Work.

7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.

8. Submit to Project Manager Lone Star Notification transmittal number prior to beginning excavation.

9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.

10. Provide adequate notice to pipe manufacture's representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.

11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Section 01330 - Submittal Procedures.

12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Project Manager by noon on Thursday of week. Contact person must be accessible during weekend, have Houston Metro Area phone number, and be authorized to make emergency decisions.

13. No night work or plant shut down will be scheduled to begin two working days before or after designated City Holidays.

G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide City a minimum of two weeks notice prior to shutting down existing water line.

3.06 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:

1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.

2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.

4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.

5. Where preventing movement of 16-inch diameter or greater pipe is necessary due to thrust, use restrained joints as shown on Drawings.

   a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.

   b. Do not include passive resistance of soil in thrust restraint calculations.

6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Project Manager.

B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.

2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.

3. Use galvanized or black nuts and bolts to match flange material. Use cadmium- plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.

4. Full length bolt isolating sleeves and washers shall be used with flanged connections. Furnish kits in accordance with City's "Approved Products List."

5. For in-line flange joints 30 inches in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between 12 inches in diameter and greater and 24

inches in diameter and smaller, provide Phenolic PSI with nitrite seal gasket conforming to ANSI A 21.11 mechanical joint gaskets.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.

2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30- inch and smaller.

3. Furnish welded joints with trimmed spigots and interior welds for 36-inch and larger pipe.

4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to 3/4 inch as long as 1 ½ inch minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 5 degrees.

5. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.

6. Protect coal-tar-epoxy lining during welding by draping an 18-inch-wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.

7. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-0XX.

8. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.

9. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.

10. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.

11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.

12. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.

13. Welded Joints for Large Diameter Water Lines:

    a. Furnish pipe with trimmed spigots and interior welds for 36-inch and larger pipe.

b. Use exterior welds for 30 inch and smaller.

c. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2 ½ degrees.

d. For large diameter water lines, employ an independent certified testing laboratory, approved by Project Manager, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Project Manager for review. Project Manager has final decision as to suitability of welds tested.

1) Weld acceptance criteria:

a) Conduct in accordance with ASTM E165- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.

b) Examine welded surfaces for the following defects:

i) Cracking.

ii) Lack of fusion/penetration.

iii) Slag which exceeds one-third (t) where (t) equals material thickness.

iv) Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width.

v) Relevant linear indications in which length of linear indication exceeds three times its width.

vi) Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge.

14. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.

15. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.

16. Provide cylindrical corrosion barriers for epoxy lined steel pipe 24-inch diameter and smaller, unless minimum wall thickness is 0.5 inches or greater.

a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.

b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience installing protection fittings.

c. All steel pipe is to have cutback 3/4 inch to no greater than 1 inch of internal diameter coating from weld bevel.

d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 213.

e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Harnessed Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe):

1. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.

2. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum 1/2- inch joint recess. Use joint "diapers" minimum of 12 inches wide.

3. For field adjustments with deflections beyond manufacturer's recommendations:

a. Field trim spigot.

b. Do not engage ring.

4. Harnessed joints are not permitted in areas defined on Drawings as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.

5. Install harness type joints including snap rings at straight sections of pipe.

E. Restrained Joints

1. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks.

2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of prestressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Project Manager. Make adjustments in thrust restraint lengths at no additional cost to City.

3. Passive resistance of soil will not be permitted in calculation of thrust restraint.

4. For 16-inch lines and larger use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.

5. Installation.

   a. Install restrained joints mechanism in accordance with manufacturer's recommendations.

   b. Examine and clean mechanism; remove dirt, debris and other foreign material.

   c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.

   d. Verify gasket is evenly seated.

   e. Do not over stab pipe into mechanism.

6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.

7. Place 2500 psi concrete conforming to Section 03315 - Concrete for Utility Construction, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

F. Joint Grout (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.

2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without retempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.

3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.

4. Follow established procedures for hot and cold weather concrete placement.

5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.

6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.

7. Interior Joints for Pipe 24 inches and Smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Project Manager for 20-inch pipe and smaller.

8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.

9. Remove and replace improperly cured or otherwise defective grout.

10. Strike off grout on interior joints and make smooth with inside diameter of pipe.

11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.

12. Interior Joints for Water Lines 30 inches and Larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Project Manager of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.

13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately 1/2 inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to City.

H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Project Manager. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.

2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.

3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.

4. Replace, repair, or reapply coatings and linings as required.

5. Assessment of deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.

6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.

I. Closures Sections and Approved Field Modifications to Steel, Concrete Cylinder Pipe, Bar Wrapped Pipe and Fittings:

1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.

2. Fill exposed interior and exterior surfaces with nonshrink grout.

3. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.

4. For large diameter water lines, provide minimum overlap of 4 inches of butt strap over adjacent piece on butt-strap closures.

3.07 CATHODIC PROTECTION APPURTENANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Project Manager.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.08 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.09 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

A. Double wrap pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.

B. Do not use polyethylene wrap if pipe is cathodically protected.

C. Conform to requirements of Section 02528 - Polyethylene Wrap.

3.10 CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.

B. Unless otherwise approved by Project Manager, comply with the following;

1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.

2. No later than three days after completing disinfection preparatory work, submit to City appropriate request for disinfection.

3. If City fails to perform initial disinfection of lines in accordance with Section 2514 - Disinfection of Water Lines, within seven days from submission of appropriate request, and if approved by Project Manager, pipe laying operations may continue beyond approved limits until the City responds.

4. Immediately after transfer of services, begin abandonment of old water lines and site restoration.

5. Do not exceed a total of 50% of total project linear feet of disturbed right- of-way and easement until site is restored in accordance with Section 01740 - Site Restoration.

6. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

C. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Section 01740 - Site Restoration. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000 linear feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

3.11 CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. City must inspect water line for cleanliness prior to filling.

3.12 DISINFECTION OF WATER LINES

A. Conform to requirements of Section 02514 - Disinfection of Water Lines.

3.13 FIELD HYDROSTATIC TESTS

A. Conform to requirements of Section 02515 - Hydrostatic Testing of Pipelines.

END OF SECTION

Section 02512

WATER TAP AND SERVICE LINE INSTALLATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Tapping existing mains and furnishing and installing new service lines for water.

B. Relocation of existing small water meters.

C. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water lines and large-diameter (greater than 20 inches) water lines. When specifications for large-diameter water lines differ from those for small- diameter water lines, paragraphs for large-diameter water lines will govern for large-diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water taps and copper service lines 3/4 inch through 1 inch is on unit price basis for each installation. Separate measurements will be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.04, Definitions.

2. Payment for water taps and service lines 1 1/2 inch through 2 inch is on unit price basis for each installation. Separate measurements will be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.04, Definitions.

3. Payment for "short side, "long side" and "extra long side" includes locating water line, tap installation and connection to meter and restoring site.

4. Payment for each small meter includes labor, materials, and equipment to relocate existing small meter.

5. No additional payment will be made for bedding, backfill, compaction, push under pavement, etc.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

B. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution.

1.04 DEFINITIONS

A. Short Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on same side of street.

B. Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance not to exceed 60 linear feet (at right angles to water line).

C. Extra Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance greater than 60 linear feet (at right angles to water line).

PART 2 P R O D U C T S

2.01 MATERIALS

A. Copper Tubing: In accordance with Section 02503 - Copper Tubing. Polybutylene tubing is not permitted.

B. Corporation Stops: AWWA C 800 as modified in this Section:

1. Inlet End: AWWA standard thread.

2. Valve Body: Tapered plug type, O-ring seat ball type, or rubber seat ball type.

3. Outlet End: Flared-copper connection for use with Type K, soft copper or compression type fitting.

C. Provide taps for water line types and sizes in accordance with pipe tapping schedule located at end of this Section.

D. Dual Strap Saddles: Red brass body and straps; ductile-iron; vinyl-coated body and straps; or ductile-iron, vinyl-coated body and stainless-steel straps.

E. Taps for PVC Water Lines: Use dual-strap or single, wide-band strap saddles which provide full support around circumference of pipe and bearing area of sufficient width along axis of pipe, 2 inches minimum, ensuring that pipe will not be distorted when saddle is tightened. Provide approved stainless-steel tapping saddle with AWWA standard thread.

F. Taps for Steel Pipe: Not allowed, unless specifically approved by Project Manager. Use saddle only when tap is approved on steel pipe.

G. Curb Stops and Brass Fittings: AWWA C 800 as modified in this Section.

1. Inlet End: Flared copper connection or compression-type fitting

2. Valve Body: Straight-through or angled, meter-stop design equipped with following:

   a. O-ring seal straight plug type.

   b. Rubber seat ball type.

3. Outlet End: Female, iron-pipe thread or swivel-nut, meter-spud thread on 3/4-inch and 1-inch stops and 2-hole flange on 1 1/2 and 2-inch sizes.

4. Fittings: Provide approved fittings. Use same size open end wrenches and tapping machines as used with respective Mueller fittings.

5. Factory Testing of Brass Fittings:

   a. Submerge in water for 10 seconds at 85 psi with stop in both closed and open positions.

   b. Reject fitting that shows air leakage. Project Manager may confirm tests locally. Entire lot from which samples were taken will be rejected when random sampling discloses unsatisfactory fittings.

H. Angle Stops: In accordance with AWWA C 800; ground-key, stop type with bronze lock- wing head stop cap; inlet and outlet threads conform to application tables of AWWA C 800; and inlets flared connection or compression.

1. Outlet for 3/4-inch and 1-inch size: Meter swivel nut with saddle support.

2. Outlet for 1 1/2-inch through 2-inch size: O-ring sealed meter flange, iron pipe threads.

I. Fittings: In accordance with AWWA C 800 and following:

1. Castings: Smooth, free from burrs, scales, blisters, sand holes, and defects which would make them unfit for intended use.

2. Nuts: Smooth cast and has symmetrical hexagonal wrench flats.

3. Flare-Joint Fittings: Smooth cast. Machine seating surfaces for metal-to-metal seal to proper taper or curve, free from pits or protrusions.
4. Thread fittings, of all types, shall have N.P.T. or AWWA threads, and protect male threaded ends in shipment by plastic coating, or approved equal.

5. Compression tube fittings shall have Buna-N beveled gasket.

6. Stamp of manufacturer's name or trademark and of fitting size on body.

PART 3 E X E C U T I O N

3.01 GENERAL

A. For service lines and lateral connections larger than those allowed in Pipe Tapping Schedule, branch connections and multiple taps may be used. Space corporation stops minimum of 2 feet apart.

B. Tapped collars of appropriate sizes: Approved in new construction only provided they are set

at right angles to proposed meter location.

C. Use tapping machine manufactured for pressure tapping purposes for 2-inch and smaller service taps on pressurized water lines.

D. For new meter or when existing meter is in conflict with proposed pavement improvements, locate water meters one foot inside street right-of-way, or when this is not feasible, one foot on curb side of sidewalk. Contact Project Manager when major landscaping or trees conflict with service line and meter box location. No additional payment will be made for work on customer side of meter.

E. New location and installation of existing small meter shall conform to requirements of this Section.

3.02 SERVICE INSTALLATION

A. Set service taps at right angles to proposed meter location and locate taps in upper pipe segment within 45 degrees of pipe springline.

B. Install service lines in open-cut trench in accordance with Section 02317 - Excavation and Backfill for Utilities. Install service lines under paved roadways, other paved areas and areas indicated on Drawings in bored hole in accordance with Paragraph 3.01G.

C. Lay service lines with minimum of 30 inches of cover as measured from top of curb or, in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of 18 inches of cover below flow line of ditches to service lines.

D. Service lines across existing street (push-unders): Pull service line through prepared hole under paving. Use only full lengths of tubing. Take care not to damage copper tubing when pulling it through hole. Compression-type union is only permitted when span underneath pavement cannot be accomplished with a full standard length of tubing. Use one compression-type union for each full length of tubing.

E. Maintain service lines free of dirt and foreign matter.

F. Install service lines so that top of meter will be 4 to 6 inches below finished grade.

G. Anticipate existing sanitary sewers to have cement stabilized sand backfill to bottom of pavement. Include cost of such crossings in unit price for services.

3.03 CURB STOP INSTALLATION

A. Set curb stops or angle stops at outer end of service line inside of meter box. Secure opening in curb stop to prevent unwanted material from entering. In close quarters, make S-curve in field. Do not flatten tube. In 3/4-inch and 1-inch services, install meter coupling, swivel-nut, or curb stop ahead of meter. Install straight meter coupling on outlet end of meter.

3.04 SEQUENCE OF OPERATIONS

A. Open trench for proposed service line in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Install curb stop on meter end of service line.

C. With curb stop open and prior to connecting service line to meter in slack position, open corporation stop and flush service line thoroughly. Close curb stop, leaving corporation stop in

full-open position.

D. Check service line for apparent leaks. Repair leaks before proceeding.

E. Schedule inspection with Project Manager prior to backfilling. After inspection, backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

F. Install meter box centered over meter with top of lid flush with finished grade. Meter box: Refer to Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

END OF SECTION

Table 02512-1

PIPE TAPPING SCHEDULE				
WATERLINE TYPE AND DIAMETER	SERVICE SIZE			
	3/4"	1"	1-1/2"	2"
4" Cast Iron or Ductile Iron	DSS,WBSS	DSS, WBSS	DSS,WBSS	DSS, WBSS
4" Asbestos Cement	WBSS	WBSS	DSS, WBSS	DSS, WBSS
4" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" Cast Iron or Ductile Iron	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" Asbestos Cement	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" Cast Iron or Ductile Iron	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" PVC (AWWA C900)	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
12" Cast Iron or Ductile Iron	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
12" Asbestos Cement	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
12" PVC (AWWA C900)	DSS,WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
16" and Up Cast Iron or Ductile Iron	DWBSS	DWBSS	DWBSS	DWBSS
16" and Up Asbestos Cement	DWBSS	DWBSS	DWBSS	DWBSS
16" and Up PVC (AWWA C900)	DWBSS	DWBSS	DWBSS	DWBSS

DSS - DUAL STRAP SADDLES
WBSS - WIDE BAND STRAP SADDLES
DWBSS - DUAL WIDE BAND STRAP SADDLES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Wet connections for new water lines and service lines to existing water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for wet connections shown on Drawings is on unit price basis for each wet connection. Separate payment will be made for each size of water line.

2. No compensation will be given for extra work or for damages occurring as result of incomplete shutoff.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

1.04 DEFINITIONS

A. Wet connections consist of isolating sections of pipe to be connected with existing valves, draining isolated sections, and completing connections.

B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of 2-inch service line.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Sections 02501 through 02528 related to piping materials and to water distribution.

B. Corporation cocks and saddles shall conform to requirements of Section 02512 - Water Tap and Service Line Installation.

C. Valves shall conform to requirements of Section 02521 - Gate Valves.

D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 E X E C U T I O N

3.01 CONNECTION OPERATIONS

A. Plan wet connections in manner and at hours with least inconvenience public. Notify Project Manager at least 72 hours in advance of making connections.

B. Do not operate valves on water lines in use by City. City of Houston Utility Operations Division will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Inspector is at job site. Connection work shall progress without interruption until complete once existing water lines have been cut or plugs have been removed for making connections.

3.02 2-INCH WET CONNECTIONS

A. Tap water line. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing water line. Use 2-inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

END OF SECTION

Section 02514

DISINFECTION OF WATER LINES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Disinfection of potable water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for disinfection of water lines under this Section. Include cost in unit price of water lines being disinfected.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Adjusting Payment for Retesting.

1. Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction will be charged to Contractor. Charges will be deducted from retainage amounts when construction estimates are processed for final payment.

3. Total charge will consist of base charge of $135.00 plus footage charge based on number of feet of specified diameter pipe in construction project. Footage charge is as follows:

Size of Pipe	Charge per Linear Foot
2 inch to 4 inch	$0.03
6 inch	$0.04
8 inch	$0.05
10 inch to 12 inch	$0.07
16 inch to 20 inch	$0.09
24 inch to 30 inch	$0.13
32 inch to 48 inch	$0.16
54 inch	$0.20
60 inch	$0.22
66 inch	$0.31
72 inch to 84 inch	$0.40
90 inch to 96 inch	$0.58
108 inch	$0.75
120 inch or larger	$1.00

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to City water distribution system.

B. Water for disinfection and flushing will be furnished by City without charge.

C. Unless otherwise provided in Contract Documents, City will conduct disinfection operations assisted by Contractor.

D. Coordinate chlorination operations through Project Manager.

3.02 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to City water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2- inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines 8 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Project Manager. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

3.03 DISINFECTION BY CITY PERSONNEL

A. Correct problems that may prevent disinfection operations prior to advising Project Manager to perform disinfection work. When disinfection work cannot be performed due to covered up valves, missing valve stacks, inoperative fire hydrants or other nonconforming construction, charge will be levied against Contractor for each trip made by City personnel.

B. Notify and coordinate with Project Manager minimum of 72 hours before disinfection work is to be performed. Assist City personnel during disinfection operations.

3.04 DISINFECTION BY CONTRACTOR

A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:

1. Use not less than 100 parts of chlorine per million parts of water.

2. Introduce chlorinating material to water lines in accordance with AWWA C 651.

3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.

4. Open and close valves in lines being sterilized several times during contact period.

5. If chemical compound is used for sterilizing agent, place in pipes as directed by Project Manager.

3.03 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, bacteriological tests will be performed by City or testing laboratory in accordance with Section 01454 - Testing Laboratory Services. When test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, assist City with additional disinfection operations.

3.06 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Field hydrostatic testing of newly installed water pipelines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Disinfect water system pipelines prior to hydrostatic testing.

B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to City water distribution system.

C. Water for testing will be charged to Contractor in accordance with City Ordinances. Prior to hydrostatic testing, obtain a transient meter from the City Deposit is required for transient meter.

D. Test pipelines in lengths between valves, or plugs, of not more than 4,000

feet. E. Conduct hydrostatic tests in presence of Project Manager.

3.02 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For small diameter pipelines, expel air and apply minimum test pressure of 125 psi. For large diameter water lines, expel air and apply minimum test pressure of 150 psi.

D. Begin test by 9:00 a.m. unless otherwise approved by Project Manager. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.

E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.03 ALLOWABLE LEAKAGE FOR WATERLINES

A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

B. Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.

C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Project Manager for leakage during pressure test may be used to fulfill requirements of this section.

3.04 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Project Manager may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 02514 - Disinfection of Water Lines. Pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.

3.05 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

Section 02516

CUT, PLUG AND ABANDONMENT OF WATER LINES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Cut, plug and abandonment of water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for cut, plug, and abandonment of water lines is on a unit price basis for each cut, plug, and abandonment performed. Separate payment will be made for each size of water line.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed plugs and clamps for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete for reaction blocks: Class B conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Plugs and clamps: Applicable for type of pipe to be plugged.

PART 3 E X E C U T I O N

3.01 APPLICATION

A. Do not begin cut, plug and abandonment operations until replacement water line has been constructed, disinfected, and tested, and service lines have been transferred to replacement water line.

B. Install plug, clamp, and concrete reaction block and make cut at location shown on Drawings.

C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than at supply water line or as shown on Drawings.

D. After water line to be abandoned has been cut and plugged, check for other sources feeding abandoned water line. When sources are found, notify Project Manager immediately. Cut and plug abandoned water line at point of other feed as directed by Project Manager.

E. Plug or cap ends or openings in abandoned water line in manner approved by Project Manager.

F. Remove and dispose of surface identifications such as valve boxes and fire hydrants. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.

G. Backfill excavations in accordance with Section 02317 - Excavation and Backfill for Utilities.

H. Repair street surfaces in accordance with Section 02951- Pavement Repair and Resurfacing.

END OF SECTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Gate valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for gate valves 20 inches in diameter and smaller under this Section. Include payment in unit price for water lines.

2. Payment for gate valves 24 inches to 36 inches in diameter is on a unit price basis. Unit price includes cost of required box for gate valves.

3. Payment for 2-inch blow-off valve with box is on a unit price basis for each installation.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.

C. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.

D. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.

E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.

G. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.

H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

D. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.05 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20- inches and smaller. When type of valve is indicated, no substitute is allowed.

C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single- wedge; disc type; screwed ends

D. Coatings for Gate Valves 2 inches and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2 inches in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.

F. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide approved double disc valves. Comply with following requirements unless otherwise specified in Drawings:

1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.

2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.

3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.

4. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.

5. O-rings: For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.

6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

G. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

H. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

I. Bolts: AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

G. Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:

1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.

2. O rings: For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.

3. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.

4. Stem Nut: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.

5. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

6. Bolts: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

7. Discs: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.

8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.

9. Provide bypass for valves 24 inches and larger.

10. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.

11. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.

12. Stuffing Boxes: Located on top of bonnet and outside gear case.

H. Gate valves 14 inches to 24 inches: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.

1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.

2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.

3. Ensure wedge is symmetrical and seals equally well with flow in either direction.

4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.

5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.

6. Provide high strength bronze stem and nut.

7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.

8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.

9. Provide thrust washers to the thrust collar for easy valve operation.

K. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

L. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

M. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.

N. Provide flanged joints when valve is connected to steel or PCCP.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Earthwork. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.02 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed.

Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.

C. For pipe section of each riser, use only 6 inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.03 DISINFECTION AND TESTING

A. Assist Project Manager with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 – Hydrostatic Testing of Pipelines.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

3.04 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground with approved paint.

END OF SECTION

Section 02527

POLYURETHANE COATINGS ON STEEL OR DUCTILE IRON PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Two-component polyurethane coating system for use as external coating for steel or ductile iron pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of polyurethane coatings in contract unit prices for steel pipe or ductile iron pipe.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 210 - Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

B. ASTM D 522 - Standard Test Method for Mandrel Bend Test of Attached Organic Coatings.

C. SSPC-PA 2 - Measurement of Dry Paint Thickness with Magnetic Gauges.

D. SSPC-PA Guide 3 - A Guide to Safety in Paint Application.

E. SSPC-PS Guide 17.00 - Guide for Selecting Urethane Painting Systems.

F. SSPC-PS10 - Near-White Blast Cleaning.

1.04 SAFETY

A. Secure, from manufacturer, Material Safety Data Sheet (MSDS) for polyurethane coatings and repair materials listed in this Section.

B. Safety requirements stated in this specification and in related sections apply in addition to applicable federal, state and local rules and regulations. Comply with instructions of coating manufacturer and requirements of insurance underwriters.

C. Follow handling and application practices of SSPC-PA Guide 3; SSPC-PS Guide 17.00; Coating Manufacturer's Material Safety Data Sheet.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit coating manufacturer's catalog sheets and technical information for approval, prior to delivery of pipe.

C. Obtain from coating manufacturer and submit coating "affidavit of compliance" to requirements of this Section stating that coatings were applied in factory and in accordance with manufacturer's minimum requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Use standard containers to prevent gelling, thickening deleteriously or forming of gas in closed containers within period of one year from date of manufacture.

B. Label each container of separately packaged component clearly and durably to indicate date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name or formula specification, number of coatings together with special instructions. Do not use coating components older than one year.

C. Deliver coating materials to pipe manufacturer in sealed containers showing designated

name, batch number, color, date of manufacture and name of coating manufacturer.

D. Store material onsite in enclosures, out of direct sunlight in warm, ventilated and dry area.

E. Prevent puncture, inappropriate opening or other action which may lead to product contamination.

PART 2 P R O D U C T S

2.01 COATING MATERIAL

A. CORROPIPE II PW - TOUCHUP (two-component) or approved equal; mix in accordance with coating manufacturer's recommendations.

1. For areas less than or equal to 6 inches in diameter, brush apply.

2. For areas greater than 6 inches in diameter, spray apply.

B. Coating System: Use Type V system which is 2-package polyisocyanate, polyol-cured urethane coating, mixed in 1:1 ratio at time of application. Components shall be balanced viscosities in their liquid state and not require agitation during use.

C. Exterior Coating Material: CORROPIPE II-TX and Joint Coating Material CORROPIPE II- PW, manufactured by Madison Chemical Industries, Inc.

D. Internal Coating Material: Joint Coating Material CORROPIPE II-PW, manufactured by Madison Chemical Industries, Inc

E. Cured Coating Properties:

1. Conversion to Solids by Volume: 97 percent plus or minus 3 percent.

2. Temperature Resistance: Minus 40 degrees F and plus 130 degrees F.

3. Minimum Adhesion: 500 psi, when applied without primer to ductile iron pipe which has been blasted to comply with SSPC-SP 10.

4. Cure Time: For handling in 1 minute at 120 degrees F, and full cure within 7 days at 70 degrees F.

5. Maximum Specific Gravities: Polyisocyanate resin, 1.20. Polyol resin, 1.15.

6. Minimum Impact Resistance: 80 inch-pounds using 1-inch diameter steel ball where coating is applied at 30 mils to ductile iron pipe surface which has been blasted to SSPC No. 10 finish.

7. Minimum Tensile Strength: 2,000 psi.
8. Hardness: 55 plus or minus 5 Shore D at 70 degrees F.

9. Flexibility Resistance: ASTM D 522 using 1-inch mandrel. Allow coating to cure for 7 days. Perform testing on test coupons held for 15 minutes at temperature extremes specified in this Paragraph.

2.02 REPAIR AND TOUCHUP MATERIAL

A. CORROPIPE II PW (Two-component, brush applied, or approved equal). Mix in accordance with coating manufacturer's recommendations.

PART 3 E X E C U T I O N

3.01 SURFACE PREPARATION

A. Remove deposits of oil, grease or other organic contaminates before blast cleaning by using solvent wash as specified in SSPC-PA Guide 3. Clean and dry surfaces making them completely dry, free of moisture, dust, grit, oil, grease or other deleterious substances prior to application of coating.

B. Exterior and Interior Surfaces: SSPC-SP10, near-white metal blast cleaning. Blast with clean, hard, sharp cutting abrasives with no steel or cast iron shot in mix.

C. Ductile Iron Pipe: Prior to start of production blasting, prepare specimens for white metal blast and near-white metal blast using equipment and abrasives proposed for work. During preparation of specimens, Change blasting intensity and abrasive as necessary to provide degree of cleaning required by SSPC-SP10, except that color of blasted substrate is not expected to match color of blasted steel. After examination and concurrence by Project Manager, production blasting may begin. Monitor and control production blasting so that production pipe surfaces match surface of approved blasting specimens.

3.02 THICKNESS

A. External Coatings: Minimum DFT of 25 mils (0.025 inch).

B. Internal Coatings: Minimum DFT of 35 mils.

C. Thickness Determinations: Use Type 1 magnetic thickness gauge as described in SSPC-PA2 specification. Individual readings below 90 percent of specified minimum are not acceptable. Average individual spot readings (consisting of three point measurements within 3 inches of each other) less than 95 percent of minimum are not acceptable. Average of all spot readings less than minimum thickness specified are not acceptable.

3.03 FACTORY APPLICATION OF POLYURETHANE COATING

A. Equipment: Two-component, 1:1 mix ratio, heated airless spray unit.

B. Temperature: Minimum 5 degrees F above dew point temperature. Temperature of surface shall not be less than 60 degrees F during application.

C. Humidity: Heating of pipe surfaces may be required to meet requirements of Paragraph 2.01E, Cured Coating Properties, when relative humidity exceeds 80 percent.

D. Do not thin or mix resins; use as received. Store resins at temperature above 55 degrees F at all times.

E. Application: Conform to coating manufacturer's recommendations. Apply directly to substrate to achieve specified thickness. Multiple-pass, one-coat application process is permitted provided maximum allowable recoat time specified by coating manufacturer is not exceeded.

F. Recoat only when coating has cured less than maximum time specified by coating manufacturer. When coating has cured for more than recoat time, brush-blast or thoroughly sand coating surface. Blow-off cleaning using clean, dry, high pressure compressed air.

G. Cure at ambient temperature above 0 degrees F. Do not handle pipe until coating has been allowed to cure as follows:

Ambient Temperature	Minimum Full Cure Time
Over 70 degrees F	7 days
50 to 70 degrees F	9 days
0 to 50 degrees F	12 days

3.04 JOINTS

A. Apply coating to unlined pipe surfaces including inside of bell socket and outside of spigot.

B. Coating thickness on sealing areas of spigot end of pipe exterior: Minimum 8 mils (0.008 inch), maximum of 10 mils (0.010 inch). Maximum 10 mils may be exceeded in spigot end provided maximum spigot diameter as specified by pipe manufacturer is not exceeded.

3.05 INSPECTION

A. Project Manager may inspect coatings at coating applicator's facilities.

B. Secure approval of surface preparation by coating manufacturer's representative prior to coating application.

C. Holiday Inspection: Conform to AWWA C 210, Section 5.3.3.1. Follow coating manufacturer's recommendation. Conduct inspection any time after coating has reached initial cure. Repair in accordance with Paragraph 3.07, Repair and Field Touchup.

3.06 PIPE INSTALLATION

A. When required by Project Manager, provide services of manufacturer's representative for period of not less than 2 weeks at beginning of actual pipe laying operations to advise Contractor regarding installation including but not limited to handling and storing, cleaning and inspecting, coatings repairs, and general construction methods as to how they may affect pipe coatings.

B. Use nylon straps, padded lifts and padded storage skids. Field cuts should be kept to minimum. Repair damage to coating due to handling or construction practices. See Section 02501 - Ductile - Iron Pipe and Fittings and Section 02502 - Steel Pipe and Fittings for additional requirements.

C. Just before each section of pipe is to be placed into trench, conduct visual and holiday inspection. Repair defects in coating system before pipe is installed.

3.07 REPAIR AND FIELD TOUCHUP

A. Apply repair and touchup materials in conformance with factory application of polyurethane coating requirements specified in this Section, excluding equipment requirements.

B. Repair Procedure - Holidays:

1. Remove traces of oil, grease, dust, dirt, and other deleterious materials

2. Roughen area to be patched by sanding with rough grade sandpaper (40 grit).

3. Apply one coat of repair material described above. Work repair material into scratched surface by brushing.

C. Repair Procedure - Field Cuts or Large Damage:

1. Remove burrs from field cut ends or handling damage and smooth out edge of polyurethane coating.

2. Remove traces of oil, grease, dust, dirt, and other deleterious materials

3. Roughen area to be patched with rough grade sandpaper (40 grit). Feather edges and include overlap of 1 inch to 2 inches of roughened polyurethane in area to be patched.

4. Apply thick coat of repair material described above. Work repair material into scratched surface by brushing. Feather edges of repair material into prepared surface. Cover at least 1 inch of roughened area surrounding damage, or adjacent to field cut.

D. Repair Procedure - Thermite Brazed Connection Bonds:

1. Remove polyurethane coating with power wire brush from area on metal surface which is to receive termite's brazed connection.

2. Grind metal surface to shiny metal with power grinder and coarse grit grinding wheel.

3. Apply thermite-brazed connection using equipment, charge and procedure recommended by manufacturer of thermite equipment.

4. After welded surface has cooled to temperature below 130 degrees F, apply protective coating repair material to weld, exposed pipe surface and damaged areas of polyurethane coating.

5. Do not cover or backfill freshly repaired areas of coating at thermite-brazed connection until repair material has completely cured. Allow material to cure in conformance with manufacturer's recommendations.

END OF SECTION

Section 02528

POLYETHYLENE WRAP

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Polyethylene wrap to be used in open-cut construction for cast iron and ductile iron pipe when cathodic protection system is not required by Drawings.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for polyethylene wrap. Include cost of polyethylene wrap in unit price for pipes and fittings to be wrapped.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCE

A. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials for a Wire and Cable.

B. AWWA C 105 - Standard for Polyethylene Encasement for Ductile-Iron Pipe System.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed film and tape for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming with requirements of AWWA C 105, 2.5 to 3 percent carbon black content, either low- or high-density:

1. Low-density polyethylene film. Low-density polyethylene film shall be manufactured of virgin polyethylene material conforming to following requirements of ASTM D 1248.

a. Raw material.
   1. Type : I.

   2. Class: C (black).

   3. Grade: E-5.

   4. Flow rate (formerly melt index): 0.4 g/10 minute, maximum.

   5. Dielectric strength: Volume resistivity, 10^{15} ohm-cm, minimum.

b. Physical properties.

   1. Tensile strength: 1,200 psi, minimum.

   2. Elongation: 300 percent, minimum.

   3. Dielectric strength: 800 V/mil thickness, minimum.

c. Thickness: Low-density polyethylene film shall have normal thickness of 0.008 inch. Minus tolerance on thickness is 10 percent of nominal thickness.

2. High-density, cross-laminated polyethylene film. High-density, cross laminated polyethylene film shall be manufactured of virgin polyethylene material conforming to following requirements of ASTM D 1248

a. Raw material.

1. Type: III.

2. Class: C (black).

3. Grade: P33.

4. Flow rate (formerly melt index): 0.4 to 0.5g/10 minute, maximum.

5. Dielectric strength: Volume resistivity, 10^{15} ohm-cm, minimum.

b. Physical properties.

1. Tensile strength: 5000 psi, minimum.

2. Elongation: 100 percent, minimum.

3. Dielectric strength: 800 V/mil thickness, minimum.

c. Thickness: Film shall have nominal thickness of 0.004 inch. Minus tolerance of thickness is 10 percent of nominal thickness.

B. Polyethylene Tape: Provide 3-inch-wide, plastic-backed, adhesive tape; Paleocene No. 900, Scotchwrap No. 50, or approved equal.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to affect snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

3.02 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.

2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.

4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.

2. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3- foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type:

1. Cut polyethylene sheet to length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

E. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by

passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

F. Openings in Encasement: Create openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with resulting damaged areas being repaired as specified.

G. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

3.03 REPAIRS

A. Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

END OF SECTION

Section 02531

GRAVITY SANITARY SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA)is on linear foot basis, complete in place, including sewer pipe, connections to existing manholes, post installation television inspection and testing. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.

2. Payment for television inspection of existing gravity sanitary sewer will be on a linear foot basis. Measurement will be taken along centerline of pipe from centerline to centerline of manholes. See Section 02558 - Cleaning and Television Inspection.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video tapes become property of City.

1.04 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe- to-manhole connections. Perform testing in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers.

B. Regulatory Requirements.

1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.

2. Make notification to Project Manager when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.

3. Lay gravity sewer lines in straight alignment and grade.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 P R O D U C T S

2.01 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Unlined reinforced concrete pipe is not acceptable.

2.02 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified

in one or more of following Sections:

1. Section 02427 - Plastic Liner for Large-Diameter Concrete Sewers and Structures.

2. Section 02501 - Ductile Iron Pipe and Fittings.

3. Section 02504 - Centrifugally Cast Fiberglass Pipe.

4. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe.

5. Section 02506 - Polyvinyl Chloride Pipe.

6. Section 02508 - Extra Strength Clay Pipe.

7. Section 02611 - Reinforced Concrete Pipe.

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.03 APPURTENANCES

A. Stacks. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

B. Service Connections. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.04 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Materials, and Section 02321 - Cement Stabilized Sand.

B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.

C. Perform work in accordance with OSHA standards. Employ trench safety system as

specified in Section 02260 - Trench Safety System for excavations over 5 feet deep.

D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency or utility company for repairs or relocations, either temporary or permanent.

E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

F. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

G. Do not allow sand, debris or runoff to enter sewer system.

3.02 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Project Manager.

B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.

C. No sewage shall be diverted into area outside of sanitary sewer.

D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Project Manager so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Project Manager.

3.03 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Section 02317 - Excavation and Backfill for Utilities.

3.04 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Project Manager.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment

indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Project Manager.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 6-inch separation distance.

L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.05 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.

3.06 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections to conform to requirements of Section 2534 - Sanitary Sewer Service Stubs or Reconnections.

B. Stacks. Construct stacks to conform to requirements of 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Construct manholes to conform to requirements of Section 02081 - Cast-in-Place Concrete Manholes, Section 02082 - Precast Concrete Manholes, and Section 02083 - Fiberglass Manholes, as applicable. Install frames, rings, and covers to conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

3.07 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Section 02533 – Acceptance Testing for Sanitary Sewers.

B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Section 02533 - Acceptance Testing for Sanitary Sewers.

C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers. Maintain piezometer installed to conform with Section 01578 - Control of Ground Water and Surface Water, until acceptance testing is completed.

3.08 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Backfill trench in specified lifts only after pipe installation is approved by Project Manager.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Section 02951 - Pavement Repair and Resurfacing.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil as specified in Section 02911 - Topsoil and apply hydromulch according to requirements of Section 02921 - Hydromulch Seeding.

E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil per Section 02911 - Topsoil. Sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.

B. Select and use closed-circuit television equipment that will produce color video tape. Produce video tape using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:

1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.

2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.

3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.

D. Provide video tapes in VHS format, recorded at Standard Play (SP). Two labels are required. Place one label on spine and other on face of each video tape. Permanently label each video tape with following information.

Spine of Tape

Wastewater File No.: _____ Contractor's Name:
Inspection Type: [ ] Survey [ ] Pre-Installation [ ] Post-Installation
Tape No.: _____ Date Televised: _____ Date Submitted:
Basin No:

Face of Tape

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street
_____	_____	_____	_____	
_____	_____	_____	_____	
_____	_____	_____	_____	
_____	_____	_____	_____	
_____	_____	_____	_____	

E. For each video tape provide completed TV Inspection Report, as attached at end of this section. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.

F. Upon completion of video tape reviews by Project Manager, Contractor will be notified regarding final acceptance of sewer segment.

END OF SECTION

A PDF version of the Television Inspection Codes can be viewed on the following web link
https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23579

TELEVISION INSPECTION CODES

HEADER INFORMATION

LOCATION

A STREET ROW, HEAVY TRAFFIC
B STREET ROW, LIGHT TRAFFIC
C EASEMENT, POOR ACCESS
D EASEMENT, GOOD ACCESS
E PARKING LOT, POOR ACCESS F PARKING LOT, GOOD ACCESS G ALLEY, POOR ACCESS
H ALLEY, GOOD ACCESS
I OPEN AREA, POOR ACCESS
J OPEN AREA, GOOD ACCESS

SURFACE COVER

A ASPHALT STREET
B CONCRETE STREET
C SHELL STREET
D SIDEWALK
E TREES/SHRUBS
F CLOSE TO FENCE
G OPEN AREA
H MOVABLE BUILDING
I UNMOVABLE BUILDING
J OVERHEAD UTILITIES
K WATERWAY OR RAILWAY
L HIGHWAY OR RUNWAY
M PIPE ABOVE GROUND

PIPE TYPE

ABS ACRYLONITRILE BUTADIENE STYRENE
BRK BRICK
CIP CAST IRON PIPE
CMP CORRUGATED METAL PIPE
CON POURED IN PLACE CONCRETE
CPP CURED IN PLACE PIPE
DIP DUCTILE IRON PIPE
FRP FIBERGLASS REINFORCED PIPE
PLP PLASTIC LINED CONCRETE PIPE
PEP POLYETHYLENE PIPE
PVC POLYVINYLCHLORIDE PIPE
RCP REINFORCED CONCRETE PIPE
RPM REINFORCED PLASTIC MORTAR PIPE
URC UNREINFORCED CONCRETE PIPE
VCP VITRIFIED CLAY PIPE

WEATHER

DRY - WET

CODE DESCRIPTIONS

CRACKS

RC-RADIAL LC-LONGITUDINAL

CODES	DESCRIPTION	USE IN
A (1)	< 1/2" W, < 1' L	CRK
B (2)	< 1/2" W, 1' - 2' L	CRK
C (3)	< 1/2" W, > 2' L	CRK
D (4)	> 1/2" W, < 1' L	CRK
E (5)	> 1/2" W, 1' - 2' L	CRK
F (6)	> 1/2" W, > 2' L	CRK
G (7)	HOLE IN PIPE - SMALL	
H (8)	PIPE MISSING - < 60°	
I (9)	PIPE MISSING - > 60°	

JOINTS

MJ - MISALIGNED JOINT BJ - BROKEN JOINT

CODES	DESCRIPTION	USE IN
A (3)	DRP JT > 90% CLEAR	MJ
B (6)	DRP JT 80 - 90% CLEAR	MJ
C (9)	DRP JT < 80% CLEAR	MJ
D (3)	SHF JT > 90% CLEAR	MJ
E (6)	SHF JT 80 - 90% CLEAR	MJ
F (9)	SHF JT < 80% CLEAR	MJ
G (1)	WD JT 2" - 3"	MJ
H (2)	WD JT 3" - 4"	MJ
I (3)	WD JT > 4"	MJ
J (2)	BRK JT - LIGHT	BJ
K (4)	BRK JT - MEDIUM	BJ
L (6)	BRK JT - HEAVY	BJ
N (0)	VISIBLE GASKET	MJ
O (0)	LEAKING AT JOINT	MJ

LATERALS (L) CODES

	DESCRIPTION
A (1)	PRT SER 0" - 1"
B (2)	PRT SER 1" - 2"
C (3)	PRT SER 2" - 3"
D (4)	PRT SER 3" +
E (5)	DEFECTIVE - SERVICE CONN.
F (6)	DEAD/UNUSED SERVICE
G (7)	FACTORY SERVICE
H (0)	PLUMBER SERVICE

ROOTS (R)

CODES	DESCRIPTION
A (1)	ROOTS - LIGHT
B (2)	ROOTS - MEDIUM
C (3)	ROOTS - HEAVY

DEBRIS (D)

CODES	DESCRIPTION
A	DEBRIS - LIGHT
B	DEBRIS - MEDIUM
C	DEBRIS - HEAVY
D	GREASE - LIGHT
E	GREASE - MEDIUM
F	GREASE - HEAVY

INFLOW/INFILTRATION (I)

CODES	DESCRIPTION
A (3)	I/I - LIGHT (0-1 GPM)
B (6)	I/I - MEDIUM (1-5 GPM)
C (9)	I/I - HEAVY (> 5 GPM)
D (2)	I/I - SOME EVIDENCE
E (4)	I/I - CONSIDERABLE EVIDENCE
F (6)	I/I - GREAT EVIDENCE
G (0)	I/I - NO EVIDENCE

ALIGNMENT (A)

CODES	DESCRIPTION
A	BEGIN 1/4 PIPE WATER
B	BEGIN 1/2 PIPE WATER
C	CAMERA UNDERWATER
D	END CAMERA UNDERWATER
E	END 1/2 PIPE WATER
F	END 1/4 PIPE WATER

STRUCTURAL

DS - DETERIORATED; OS - OVALITY; CS - COLLAPSED

CODES	DESCRIPTION	USE IN
A (3)	LINE DET - LIGHT	DS
B (6)	LINE DET - MEDIUM	DS
C (9)	LINE DET - HEAVY	DS
D (3)	OVAL < 5%	OS
E (6)	OVAL > 5% & < 10%	OS
F (9)	OVAL > 10%	OS
G (9)	COLLAPSED	CS
H (0)	PIPE DET - HEAVY	DS
L (0)	PIPE DET - LIGHT	DS
M (0)	PIPE DET - MEDIUM	DS
N (0)	PIPE DET - NONE	DS
O	LINE DET - NONE	DS
Z (0)	AT MANHOLE NUMBER	CS

Section 02506

POLYVINYL CHLORIDE PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 48 inches.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for work included as specified in the following sections:

a. Section 02511 - Water Lines

b. Section 02531 - Gravity Sanitary Sewers

c. Section 02532 - Sanitary Sewer Force Mains

d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC)

Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches through 48 Inches for Water.

P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.

R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.

S. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.

T. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

U. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.05 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Project Manager for review. Cost of testing paid by Contractor.

PART 2 P R O D U C T S

2.01 MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.

1. Pipe Material:

   a. DR 18: For restrained joints where shown on Drawings.

   b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.

1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.

2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:

1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.

2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.

3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

H. Do not use PVC in potentially or known contaminated areas.

I. Do not use PVC in areas exposed to direct sunlight.

2.02 WATER SERVICE PIPE

A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 14 inch through 20 inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other

methods of providing curves and bends for review by Project Manager.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

2.03 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

WALL CONSTRUCTION	MANUFACTURER	ASTM DESIGNATION	SDR (MAX.)/ STIFFNESS	DIAMETER SIZE
Solid	J-M Pipe CertainTeed Diamond Uponor ETI North American	D3034	SDR 26 / PS	6" to 10"
		D3034	SDR 35 / PS	12" & 15"
		F679	SDR 35 / PS	18" to 27"
		AWWA C900	DR 18 / N/A	4" to 12"
		AWWA C909	DR 18 / N/A	4" to 12"
		AWWA C905	DR 18 / N/A	14" to 16"
Truss (Gasketed)	Contech	D2680	N/A /200 psi	8" to 15"
Profile	Contech A-2000	F949	N/A / 46 psi	12" to 36"
	Contech A-2026	F949	N/A / 115 psi	8" to 10"
	ETI, Ultra-Rib	F794	N/A / 46 psi	8" to 30"
	ETI, Ultra-Corr	F794	N/A / 46 psi	24" to 36"

B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Project Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.

H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.

I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

2.04 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 02532 - Sanitary Sewage Force Mains.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Section 02501 - Ductile Iron Pipe and Fittings, Paragraph 2.04, except furnish fittings with one of following approved internal linings:

1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting

2. Nominal 40 mils (35 mils minimum) polyurethane

3. Nominal 40 mils (35 mils minimum) ceramic epoxy
4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 02528 - Polyethylene Wrap.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

2.05 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 E X E C U T I O N

3.01 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer’s recommendations.

3.02 INSTALLATION

A. Conform to requirements of Section 02511 - Water Lines, Section 02531 - Gravity Sanitary Sewers, and Section 02532 - Sanitary Sewer Force Mains, as applicable.

B. Install PVC pipe in accordance with Section 02317 - Excavation and Backfill for Utilities, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:

1. Water service pipe 12 inches in diameter and smaller 4 feet of cover.

2. Water service pipe 16 inches in diameter and larger 5 feet of cover.

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.

F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.

G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

3.03 PVC RESTRAINED MECHANISM

A. Do not apply lubricant to spline or pipe or coupling spline grooves.

B. Do not use excessive force while inserting the spline through coupling.

C. Insert spline until it is fully seated around circumference of pipe.

D. Field Cutting of Pipe Ends:

1. Perform by workers certified by manufacturer.

2. Use a PVC pipe cutter and provide square ends.

3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION

Section 02581

STREET LIGHTING CONDUIT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Pull box and conduit installation for electrical service to thoroughfare street lights.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for conduit is on linear foot basis measured horizontally between pull holes, pull boxes and terminal poles.

2. Refer to Section 01270 - Measurement and Payment for Unit Price Procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

1.03 REFERENCES

A. Houston Lighting and Power (HL&P) Specification Number 007-371-08. Specification for Installation of Conduit System for Thoroughfare Street Lighting.

PART 2 P R O D U C T S

2.01 MATERIALS

A. HL&P furnished material:

1. Materials Specifications in Paragraph 3.0 of HL&P Specifications Number 007-371-08.

B. Provide following material:

1. Materials specified in Paragraphs 7, 8, and 9 of HL&P Specifications number 007-371-08.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify lines and grades are correct. Determine if existing underground utilities or other obstructions may conflict with conduit installation shown on Drawings. Notify Project Manager of potential conflicts.

3.02 PREPARATION

A. Order pull boxes and warning tape from HL&P Customer Relations Representative three working days in advance of need. Verify requirements for "driveway" pull boxes for concrete areas subject to vehicular traffic and confirm total number of pull boxes required with HL&P Customer Relations Representative.

B. Obtain HL&P furnished materials Tuesday through Friday, excluding holidays, from Street Light Office at Magnolia Park Service Center, 104 North Greenwood, Houston.

3.03 INSTALLATION

A. Notify HL&P street lighting Engineer at least 2 working days in advance of scheduled conduit installation.

B. Install conduit in accordance with Paragraphs 7 through 9 and drawings pages 9 through 12 of HL&P Specification Number 700-371-08.

3.04 QUALITY CONTROL

A. Correct nonconforming conduit and pull box installations and obtain written notification from inspector that installation meets HL&P requirements.

B. Forward one copy of notification to HL&P Customer Relations Representative.

3.05 PROTECTION

A. Protect conduits and pull holes from damage or blockage until street light and circuit installation by HL&P.

B. Clear blockage in conduits prior to HL&P circuit installation.

END OF SECTION

Section 02611

REINFORCED CONCRETE PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete pipe for sanitary sewers and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for reinforced concrete pipe under this Section. Include cost in unit price Work as specified in following Sections:

a. Section 02426 - Sewer Line in Tunnels.

b. Section 02531 - Gravity Sanitary Sewers.

c. Section 02631 - Storm Sewers.

2. Refer to Section 01270- Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.

C. ASTM C 497 - Standard Test Method for Concrete Pipe, Manhole Sections, or Tile.

D. ASTM C 506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe

E. ASTM C 655 - Standard Specification for Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.

F. ASTM C 877 - Standard Specification for External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit complete product data for pipe, fittings and gaskets for approval. Indicate conformance to appropriate reference standards.

C. Submit manufacturer's certificate that concrete pipes meet applicable standards.

D. For jacking pipe, submit drawings and data describing grouting port design and closure procedures when required by Section 02431 - Tunnel Grout, including liner repair, as applicable.

PART 2 P R O D U C T S

2.01 REINFORCED CONCRETE PIPE

A. Conform circular reinforced concrete pipe to requirements of ASTM C 76, for Class III wall "B" thickness. Conform to rubber gasket joints for sanitary sewers and storm sewers and tongue and groove for roadside ditch culverts to ASTM C 443.

B. Conform reinforced concrete arch pipe to requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Use rubber gasket joints conforming to ASTM C 877.

D. Conform reinforced concrete D-load pipe requirements of ASTM C 655.

2.02 GASKETS

A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM

C 877 for reinforced concrete elliptical pipe.

B. Use the following gasket materials for pipes to be installed in potentially contaminated areas, especially where free product is found near elevation of proposed sewer:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by pipe manufacturer

2.03 LINERS FOR SANITARY SEWER PIPE

A. Reinforced concrete pipe for sanitary sewers shall be PVC lined and conform to Section 02427 - Plastic Liner for Large Diameter Concrete Sewers and Structures.

B. Reinforced concrete pipes to be installed in potentially contaminated areas shall have liners recommended by manufacturer as resistant to contaminants identified in Phase II Environmental Site Assessment Report.

2.04 SOURCE QUALITY CONTROL

A. Representatives of City Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Conform to requirements of following Sections, as applicable:

1. Section 02448 - Pipe and Casing Augering for Sewers.

2. Section 02531 - Gravity Sanitary Sewers.

3. Section 02631 - Storm Sewers.

4. Section 02441 - Micro-tunneling and Pipe-Jacked Tunnels.

B. Install reinforced concrete pipe in accordance with manufacturer's recommendations.

END OF SECTION

Section 02631

STORM SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for storm sewers, including elliptical or box, installed by open-cut, augered with or without casing, or tunneling is on linear foot basis. Measurement for storm sewers and roadside ditch culverts will be taken along center line of pipe from center line to center line of manholes or from end to end of culverts. Payment will be made for each linear foot installed complete in place, including connections to existing manholes and inlets.

2. Payment for storm sewer leads, including elliptical leads, is on a linear foot basis.

3. Payment for corrugated metal pipe storm sewer outfall, including timber bents, is on a linear foot basis.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

1.04 QUALITY ASSURANCE

A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe- to-pipe joints and in pipe-to-manhole connections.

B. Provide manufacturer's certification to Specifications.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations.

B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use Materials cracked, gouged, chipped, dented, or otherwise damaged shall not be use materials for installation.

C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.

E. Keep interiors of pipe and fittings free of dirt and foreign matter.

F. Store PVC pipe out of direct sunlight.

PART 2 P R O D U C T S

2.01 PIPE

A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.

B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Project Manager or otherwise shown on Drawings.

C. Existing pipe that has been removed during construction cannot be reused.

2.02 PIPE MATERIAL SCHEDULE

A. Storm Sewer Pipe: Use pipe materials that conforming to requirements specified in one or more of the following Sections as shown on the Drawings.

1. Section 02506 - Polyvinyl Chloride Pipe. Not allowed in the following applications:

a. Potentially Petroleum Contaminated Areas (PPCA).

b. Augering/ jacking

2. Section 02611 - Reinforced Concrete Pipe.

3. Section 02641 - Monolithic Reinforced Concrete Sewers.

4. Section 02612 - Precast Reinforced Concrete Box Sewers.

5. Section 02642 - Corrugated Metal Pipe use only where Corrugated Metal Pipe is shown on Drawings.

B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials that conforming to requirements specified in one or more of the following Sections as shown on the Drawings.

1. Section 02505 – Polyethylene Pipe. Use for Residential Culverts only. Use Concrete Pipe for long run culverts.

2. Section 02611 - Reinforced Concrete Pipe.

3. Section 02641 - Monolithic Reinforced Concrete Sewers.

4. Section 02612 - Precast Reinforced Concrete Box Sewers.

C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

D. Pipe materials other than those listed above shall not be used for storm sewers.

2.03 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill Material: Conform to requirements of Sections 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Material, and Section 2321 - Cement Stabilized Sand.

B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

C. Use cement stabilized sand material for bedding and backfill in the pipe zone for all storm sewers.

D. For storm sewer pipes 42 inches in diameter and larger, use suitable on-site material or select backfill from 12 inches above the pipe to 12 inches below the pavement for backfill.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affects traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections while Work is in progress or where traffic is affected by Work.

C. Immediately notify agency or company owning utility lines which are damaged, broken, or disturbed. Obtain approval from Project Manager and agency for repairs or relocations, either temporary or permanent.

D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

E. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

3.02 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of Work. Or use of appropriately sized grade boards which are substantially supported.

C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 6 inches.

3.03 PIPE INSTALLATION

A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.

B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Project Manager.

C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.

D. Install pipe with bells of pipe facing upstream of anticipated flow.

E. Form concentric joint with each section of adjoining pipe to prevent offsets.

F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Project Manager, provide end protection to prevent damage while using back hoes or similar powered equipment to drive home newly laid sections.

G. Keep interior of pipe clean as installation progresses.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.

J. For PVC Pipe:

1. Provide a minimum cover as per City Standard detail from top of pavement to top of pipe, but no less than 2 feet.

2. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.

3. Provide pipe sections in standard lengths with minimum length of 13 feet. Pipe may be field modified to shorten length no less than 4 feet, unless otherwise approved by Project Manager. Field modify pipe per manufacturer's recommendations.

4. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.

5. Provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.

3.04 PIPE INSTALLATION OTHER THAN OPEN CUT

A. Conform to requirements of Section 02448 - Pipe and Casing Augering for Sewers where required.

B. Conform to requirements of Section 02441 - Microtunneling and Pipe-Jacking Tunnels where required.

C. Not allowed for plastic sewer pipe.

3.05 INSTALLATION OF APPURTENANCES

A. Construct manholes to conform to requirements of Sections 02081 - Cast-in-place Concrete Manholes, Section 02082 - Precast Concrete Manholes, and Section 2087 - Brick Manholes for Storm Sewers. Install frames, grate rings, and covers to conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

B. Install PVC pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars. Refer to City Standards detail for end treatment requirements.

C. Install inlets, headwalls, and wingwalls to conform to requirements of Section 02632 - Cast- in-place Inlets, Headwalls, and Wingwalls and Section 02633 - Precast Concrete Inlets, Headwalls, and Wingwalls.

D. Rehabilitate existing manholes to conform to requirements of Section 02555 - Manhole Rehabilitation. Adjust manhole covers and inlets to grade conforming to requirements of Section 02086 - Adjusting Manholes, Inlets, and Valve Boxes to Grade.

E. Dimension for Type C and Type E manholes shall be as shown on Drawings.

3.06 INSPECTION AND TESTING

A. Perform post installation television inspection in accordance with Section 02531 - Gravity Sanitary Sewers. Hand held cameras may be used in storm sewers in lieu of requirements of Paragraph 3.09 of Section 02531 – Gravity Sanitary Sewers. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.

3.07 BACKFILL AND SITE CLEANUP

A. Backfill trench after pipe installation is inspected and approved by Project Manager.

B. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

C. Repair and replace removed or damaged pavement and sidewalks as specified in Section 02951 - Pavement Repair and Resurfacing.

D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and seed according to requirements of Section 02921 - Hydromulch Seeding, or Section 02922 - Sodding, as required.

END OF SECTION

Section 02632

CAST-IN-PLACE INLETS, HEADWALLS AND WINGWALLS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Cast-in-place inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Cast-in-place headwalls including wingwalls for storm sewers.

C. Cast-in-place junction box with lid or grate top.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for inlets is on unit price basis for each inlet installed.

2. Payment for headwalls including wingwalls is on unit price basis for each headwall including wingwall installed.

3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.

4. Payment for inlets and for culvert headwalls including wingwalls and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings for approval of design and construction details for cast-in-place units which differ from units shown on Drawings.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Class A concrete with minimum compressive strength of 4000 psi conforming to requirements of Section 03315 - Concrete for Utility Construction, unless otherwise indicated on Drawings.

B. Reinforcing Steel: Conform to requirements of Section 03315 - Concrete for Utility Construction.

C. Concrete Bricks - Conform to requirements of Section 04210 - Brick Masonry for Utility Construction. Use manhole bricks.

D. Mortar and Hydraulic Cement - Conform to requirements of Section 04061 - Mortar.

E. Miscellaneous metals: Cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

A. Construct units complete in place to dimensions, lines and grades as shown on Drawings.

B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

C. Construct box section of inlet of Class A concrete or brick.

D. Plaster brick inlets with 1/2 inch mortar on inside. Use walls for brick inlets minimum of 8 inches thick. Conform to the requirements of Section 04210 - Brick Masonry for Utility Construction.

E. Forms required for both outside and inside faces of concrete inlet walls, however, when nature of material excavated for inlet can be hand trimmed to smooth vertical face, outside forms may be omitted with approval of Project Manager.

F. Place reinforcing steel to conform to details shown on Drawings. Provide positive means for holding steel cages in place during concrete placement. Welding of reinforcing steel is not permitted unless noted on Drawings. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.

G. Chamfer exposed edges unless otherwise indicated on Drawings.

3.03 FINISHES

A. Cut off inlet leads neatly at inside face of inlet wall. Point up with mortar.

B. When box section of inlet complete, shape floor of inlet with mortar to conform to detailed Drawings.

C. Finish concrete surfaces in accordance with requirements of Section 03315 - Concrete for Utility Construction.

3.04 QUALITY CONTROL

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS

A. Connect inlet leads to inlets.

B. Seal leads inside and outside with hydraulic cement.

3.06 BACKFILL

A. Backfill area of excavation surrounding each completed inlet according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

Section 02633

PRECAST CONCRETE INLETS, HEADWALLS, AND WINGWALLS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Precast concrete headwalls and wingwalls for storm sewers.

C. Precast junction box with lid or grate top.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for inlets is on unit price basis for each inlet installed.

2. Payment for headwalls and wingwalls is on unit price basis for each headwall and wingwall installed.

3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.

4. Payment for inlets, headwalls, wingwalls, and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.05 STORAGE AND SHIPMENT

A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4000 psi.

B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:

1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.

2. Welding of reinforcing steel is not permitted unless noted on Drawings.

C. Mortar and Hydraulic Cement: Conform to requirements of Section 04261 - Mortar.

D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

2.02 SOURCE QUALITY CONTROL

A. Tolerances: Allowable casting tolerances for concrete units are plus or minus 1/4 inch from dimensions shown on Drawings. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:

1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.

2. Surface defects indicating honeycombed or open texture.

3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.

D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.

E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Project Manager, repaired units conform to requirements of these specifications.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.

B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.

D. Provide adequate means to lift and place concrete units.

3.03 FINISHES

A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.

B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.

C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.

3.04 INLET WATERTIGHTNESS

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS

A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.06 BACKFILL

A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

Section 02711

HOT MIX ASPHALT BASE COURSE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of compacted mixture of coarse and fine aggregates, and asphalt binder.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hot mix asphalt base is on a per ton basis.

2 Payment for hot mix asphalt base for transitions and base repairs is on a per ton basis.

3. Payment for hot mix asphaltic base for temporary driveway, roadway shoulders, etc., is on a per ton basis.

4. Measurement for utility projects:

a. Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.

b. Include installed hot mix asphalt base course material that extends one

foot beyond outside edge of pavement to be replaced, except where proposed pavement section shares common edge with existing pavement section.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO T201 - Standard Specification for Kinematic Viscosity of Asphalts (Bitumens).

B. AASHTO T202 - Standard Specification for Viscosity of Asphalt by Vacuum Capillary Viscometer.

C. ASTM C 33 - Standard Specifications for Concrete Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

E. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM D 4402 - Standard Test Method for Viscosity Determination of unfilled Asphalt Using the Broolfield Thermal Apparatus.

G. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.

H. TxDOT Tex-126-E - Molding, Testing, and Evaluating Bituminous Black Base Material.

I. TxDOT Tex-200-F- Sieve Analysis of Fine and Course Aggregates.

J. TxDOT Tex-203-F - Sand Equivalent Test.

K. TxDOT Tex-204-F - Design of Bituminous Mixtures.

L. TxDOT Tex-207-F - Determining Density of Compacted Bituminous Mixtures.

M. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

N. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates that asphalt materials and aggregates meet requirements of Paragraph 2.01, Materials.

C. Submit proposed mix and test data for each type of base course in Work.

D. Submit manufacturer's description and characteristics of mixing plant for approval.

E. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Coarse Aggregate:

1. Use crushed gravel or crushed stone, or combination retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic, or other injurious material occurring either free or as coating on aggregate. Conform aggregate o ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

2. Reclaimed asphalt pavement (RAP) or reclaimed Portland cement concrete pavement (RPCCP) are permitted as aggregates for hot mix asphalt base course if combined aggregate criteria, gradation, and mixture properties are met.

B. Fine Aggregate: Sand or stone screenings, or combination thereof, passing No. 10 sieve. Conform aggregate to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other deleterious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by TxDOT Tex-106-E. Sand equivalent shall have minimum value of 45 when tested by TxDOT Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with ASTM C 136. Provide either coarse or fine aggregate where designated on the Drawings.

GRADATION OF COMPOSITE AGGREGATE Percent Passing		
Sieve Size	Type A Coarse	Type B Fine
1	10	-
1	95 to	-

1"	-	10
7/8"	70 to	95 to
5/8"	-	75 to
1/2"	50 to	
3/8"	-	60 to
#4	30 to	40 to
#1	30 to	27 to
#4	5 to	10 to
#8	2 to	3 to
#20	1 to	1 to
VMA % Minimum	11	12
*2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve		

D. Asphalt Binder: Moisture-free homogeneous material meeting following requirements:

SPECIFICATION	PG 64 – 22
Average 7-day Maximum Pavement Design Temperature, degrees	<64
Minimum Pavement Design Temperature, degrees C[a]	>-22
Original Binder	
Flash Point Temperature, T48, Minimum degrees C	230
Viscosity, ASTM D 4402, [b] Maximum 3 Pa.s (3000cP), Test Temperature, degrees C	135
Dynamic Shear, TP5; [c]G*/sine[], Minimum, 1.00kPaTest Temperature @	64
Rolling Thin Film Oven (T240) or Thin Film Oven (T179) Residue	
Mass Loss, Maximum, %	- 1.00
Dynamic Shear, TP5; G*/sine[], Minimum, 2.20 kPa Test Temperature @ 10rad/sec, degrees C	64
Pressure Aging Vessel Residue (PPI)	
PAV Aging Temperature, degrees C [d]	100
Dynamic Shear, TP5; G*/sine[], Maximum, 5000 kPa Test Temperature @	25
Physical Hardening [e]	Repor
Creep Stiffness, TP1; [f] S, Maximum, 300 Mpa; m-value, Minimum, 0.300 Test	-12

Direct Tension, TP3; [f] Failure Strain, Minimum, 1.0%; Test Temperature @ 1.0 mm/min, degrees C	-12

E. Reclaimed asphalt pavement (RAP) may be used at a rate no greater than 20 percent.

2.02 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuous mixtures meeting specifications. With exception of a drum mix plant, the plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors.

B. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device

2. Dryer

3. Screens

4. Aggregate weight box and batching scales

5. Mixer

6. Asphalt storage and heating devices

7. Asphalt measuring devices

8. Truck scales

C. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix. One cold feet bin per stockpile is required.

2.03 MIXES

A. Employ certified testing laboratory to prepare design mixes.

1. Test in accordance with TxDOT Tex-126-E, TxDOT Tex-204-F, TxDOT Tex-208-F, and TxDOT Tex-227-F.

2. Verify mixture design properties for plant-produced mixture. Demonstrate that asphalt plant is capable of producing mixture meeting design volumetric and stability requirements before placement begins.

B. Density, Stability, and Air Voids Requirements. Select asphalt binder content for base courses to result in 3 to 5 percent air voids in laboratory molded

specimens, while meeting minimum VMA requirement for selected mixture classification.

PART 3 - E X E C U T I O N

3.01 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Verify lines and grades are correct.

C. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation or Section 02336 - Lime Stabilized Subgrade and Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and 02338 - Portland Cement Stabilized Subgrade. Subgrade preparation may also refer to Section 02321 - Cement Stabilized Sand or Section 02713 - Recycled Crushed Concrete Base Course.

D. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

3.02 PLACEMENT

A. Place base when surface temperature taken in shade and away from artificial heat is above 40 degrees F and rising. Do not place asphalt base when temperature of surface to receive base course is below 50 degrees F and falling.

B. Haul prepared and heated asphalt base mixture to project in tight vehicles previously cleaned of foreign material. Mixture shall be at temperature between 250 degrees F and 325 degrees F when laid.

C. Place hot mix asphalt base course in compacted lifts no greater than 4 inches thick, unless permitted in writing by Engineer.

D. Place courses as nearly continuously as possible. Place material with approved mechanical spreading and finishing machine of screeding or tamping type. Spread lifts to attain smooth course of uniform density to section, line, and grades as indicated on Drawings.

E. In areas with limited space where use of paver or front-end loader is impractical, spread by hand and compact asphalt by mechanical means. Carefully place materials to avoid segregation of mix; do not broadcast material. Remove lumps that do not break down readily.

3.04 JOINTS

A. Transverse Joints. Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back placed

material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

B. Existing pavement. When new asphalt is laid against existing asphalt pavement, saw cut existing asphalt to full depth creating vertical face. Clean joint and apply tack coat before placement.

3.05 COMPACTION

A. Construct test strip to identify correct type, number, and sequence of rollers necessary to obtain specified in-place density or air-voids. Prepare test strip at least 500 feet in length, comparable to placement and compaction conditions for Project.

B. Begin rolling while pavement is still hot and as soon as it will bear roller without undue displacement or hair line cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water; do not use petroleum by-products.

C. Compact surface thoroughly and uniformly with power-driven equipment capable of obtaining required compaction. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mat temperature drops below 175 degrees F.

D. Along walls, curbs, headers, similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

E. Compact base course to a minimum density of 91 percent (TxDOT Tex-227-F).

3.06 TOLERANCES

A. Pavement Repairs.

1. Furnish templates for checking surface of finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/4 inch.

2. Completed surface, when tested with 10 foot straight edge laid parallel to center line of pavement, shall show no deviation in excess of 1/4 inch in 10 feet. Correct surface not meeting this requirement.

3.07 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. For in-place depth and density, take minimum of one core at random locations for each 1000 feet of single lane pavement. On a 2-lane pavement, take

samples at random every 500 feet from alternating lanes. Take cores for parking lots every 500 square yards of base to determine in-place depth and density. If cul-de sac or streets are less than 500 feet, minimum of 2 cores (one per lane) will be procured. On small projects, take a minimum of two cores for each day's placement. For first days placement and prior to coring, minimum of 5 nuclear gauge readings will be performed at each core location to establish correlation between nuclear gauge (wet density reading) and core (bulk density). This process will continue for each day's placement until engineer determines that a good bias has been established for that nuclear gauge.

C. Determine in-place density in accordance with TxDOT Tex-207-F and Tex-227-F from cores or sections of asphaltic base located near each core. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Project Manager.

D. Request, at option, three additional cores within a 5-foot radius of core indicating nonconforming in-place depth at no additional cost to City. In-place depth at these locations shall be average depth of four cores.

E. Fill cores and density test sections with new compacted asphalt base or cold patch material.

3.08 NONCONFORMING PAVEMENT

A. Re-compact and retest nonconforming street sections not meeting surface test requirements. Patch asphalt pavement sections in accordance with procedures established by Asphalt Institute. Retesting is at no cost to the City.

B. Remove and replace areas of asphalt base found deficient in thickness by more than 10 percent. Remove and replace areas of asphalt base found deficient in density. Use new asphalt base of thickness shown on Drawings.

C. Replace or correct nonconforming pavement sections at no additional cost to City.

3.09 PROTECTION

A. Do not open base to traffic until 12 hours after completion of rolling, or as shown on Drawings.

B. Maintain asphalt base in good condition until completion of Work.

C. Repair defects immediately by replacing base to full depth.

END OF SECTION

Section 02712

CEMENT STABILIZED BASE COURSE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of cement stabilized crushed stone.

B. Foundation course of cement stabilized bank run gravel.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for cement stabilized base course is on square yard basis. Separate pay items are used for each different required thickness of base course.

2. Payment for asphaltic seal cure is by gallon.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

4. Refer to Paragraph 3.09, Unit Price Adjustment.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in Los Angeles Machine.

B. ASTM C 150 - Standard Specification for Portland cement.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft^3 (600kN kN-m/m^3).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

H. TxDOT Tex-110-E - Particle Size Analysis of Soils.

I. TxDOT Tex-120-E - Soil-Cement Testing.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit samples of crushed stone, gravel, and soil binder for testing.

C. Submit manufacturer's description and characteristics for pug mill and associated equipment, spreading machine, and compaction equipment for approval.

1.05 TESTS

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform tests and analysis of aggregate and binder materials in accordance with ASTM D 1557 and ASTM D 4318.

1.06 DELIVERY, STORAGE AND HANDLING

A. Make stockpiles from layers of processed aggregate to eliminate segregation of materials. Load material by making successive vertical cuts through entire depth of stockpile.

B. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 P R O D U C T S

2.01 CEMENT

A. ASTM C 150 Type I; bulk or sacked.

2.02 WATER

A. Clean, clear; and free from oil, acids, alkali, or vegetable matter.

2.03 AGGREGATE

A. Crushed Stone: Material retained on No. 40 Sieve meeting following requirements:

1. Durable particles of crusher-run broken limestone, sandstone, or granite obtained from approved source.

2. Los Angeles abrasion test percent of wear not to exceed 40 when tested in accordance with ASTM C 131.

B. Gravel: Durable particles of bank run gravel or processed material.

C. Soil Binder: Material passing No. 40 Sieve meeting following requirements when tested in accordance with ASTM D 4318:

1. Maximum Liquid limit: 35.

2. Maximum Plasticity index: 10.

D. Mixed aggregate and soil binder shall meet the following requirements:

1. Grading in accordance with TxDOT Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Retained			
	Crushed Stone	Processed G. 1	Gravel G. 2	Bank run Gravel
1 3/4 inch	0 to 10	0 to 5	-	0 to 5
1/2 inch	-	-	0	-
No. 4	45 to 75	30 to 75	15 to 35	30 to 75
No. 40	55 to 80	60 to 85	55 to 85	65 to 85

2. Obtain prior permission from Project Manager for use of additives to meet above requirements.

2.04 ASPHALT SEAL CURE

A. Cutback Asphalt: MC30 conforming to requirements of Section 02742 - Prime Coat.

B. Emulsified Petroleum Resin: EPR-1 Prime conforming to requirements of Section 02742 - Prime Coat.

2.05 MATERIAL MIX

A. Design mix for minimum average compressive strength of 200 psi at 48 hours using TxDOT Tex-120-E unconfined compressive strength testing procedures. Provide minimum cement content of 1 1/2 sacks, weighing 94 pounds each, per ton of mix.

B. Increase cement content when average compressive strength of tests on field samples fall below 200 psi. Refer to Part 3 concerning field samples and tests.

C. Mix in stationary pug mill equipped with feeding and metering devices for adding specified quantities of base material, cement, and water into mixer. Dry

mix base material and cement sufficiently to prevent cement balls from forming when water is added.

D. Resulting mixture shall be homogeneous and uniform in appearance.

2.06 SOURCE QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform testing for unconfined compressive strength by TxDOT Test Method Tex-120-E as follows:

1. Mold three samples each day or for each 300 tons of production.

2. Compressive strength shall be average of three tests for each production lot.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation.

C. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

3.03 PLACEMENT

A. Do not mix and place cement stabilized base when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Place material on prepared subgrade in uniform layers to produce thickness indicated on Drawings. Depth of layers shall not exceed 6 inches.

C. Spread with approved spreading machine. Conduct spreading so as to eliminate planes of weakness or pockets of non-uniformly graded material

resulting from hauling and dumping operations.

D. Provide construction joints between new material and stabilized base that has been in place 4 hours or longer. Joints shall be approximately vertical. Form joint with temporary header or make vertical cut of previous base immediately before placing subsequent base.

E. Use only one longitudinal joint at center line under main lanes and shoulder unless shown otherwise on Drawings. Do not use longitudinal joints under frontage roads and ramps unless indicated on Drawings.

F. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure firm bond between reinforcement and base.

3.04 COMPACTION

A. Start compaction as soon as possible but not more than 60 minutes from start of moist mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow stabilized base to mix with underlying material.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 2 percent above optimum moisture as determined by ASTM D 698. Mix in with spiked tooth harrow or equal. Reshape surface and lightly scarify to loosen imprints made by equipment.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers which are sufficiently light to prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

F. Compact to minimum density of 95 percent of maximum dry density at moisture content of treated material between optimum and 2 percent above optimum as determined by ASTM D 1557, unless otherwise indicated on Drawings.

G. Maintain surface to required lines and grades throughout operation.

3.05 CURING

A. Moist cure for minimum of 7 days before adding pavement courses. Restrict traffic on base to local property access. Keep subgrade surface damp by sprinkling.

B. If indicated on Drawings, cover base surface with curing membrane as soon as

finishing operation is complete. Apply with approved self-propelled pressure distributor at following rates, or as indicated on Drawings:

1. MC30: 0.1 gallon per square yard.

2. EPR-1 Prime: 0.15 gallon per square yard.

C. Do not use cutback asphalt during period of April 16 to September 15.

3.06 TOLERANCES

A. Smooth and conform completed surface to typical section and established lines and grades.

B. Top surface of base course: Plus or minus 1 1/4 inch in cross section, or in 16 foot length.

3.07 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Take minimum of one core at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Request additional cores in vicinity of cores indicating nonconforming in-place depths at no extra cost to City. When average of tests fall below required depth, place additional material and compact at no additional cost to City.

D. Perform compaction testing in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017 at randomly selected locations. Remove and replace areas that do not conform to compaction requirements at no additional cost to City.

E. Fill cores and density test sections with new compacted cement stabilized base.

3.08 NONCONFORMING BASE COURSE

A. Remove and replace areas of base course found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with cement-stabilized base of thickness shown on Drawings.

B. Replace nonconforming base course sections at no additional cost to City.

3.09 UNIT PRICE ADJUSTMENT

A. Make unit price adjustments for in-place depth determined by cores as follows:

1. Adjusted unit price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.

2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.

3.10 PROTECTION

A. Maintain stabilized base in good condition until completion of Work. Repair defects immediately by replacing base to full depth.

B. Protect asphalt membrane, when used, from being picked up by traffic. Membrane may remain in place when proposed surface courses or other base courses are to be applied.

END OF SECTION

Section 02713

RECYCLED CRUSHED CONCRETE BASE COURSE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Recycled crushed concrete base (RCCB) course.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for RCCB is on per ton basis furnished and compacted in place.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 150 - Standard Specification for Portland cement.

B. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.

D. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

E. TxDOT Tex-113-E - Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials.

F. TxDOT Tex-115-E - Field Method for Determining In-place Density of Soils and Base Materials.

G. TxDOT Tex-120-E - Soil-Cement Testing.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit representative samples of crushed concrete for testing.

C. Submit weight tickets, certified by supplier, for each delivery of recycled crushed concrete, gravel, and soil binder.

D. Submit manufacturer's description and characteristics for pug mill and associated equipment, mixer trucks, spreading and compaction equipment for approval.

1.05 TESTS

A. Follow Section 01454 - Testing Laboratory Services.

B. Test and analyze aggregate and binder products following TxDOT Tex-110-E.

1.06 DELIVERY, STORAGE AND HANDLING

A. Provide materials from stockpiles that are protected during storage from contaminates detrimental to concrete base.

B. Load material from same area of stockpile to maintain uniformity of each successive delivery to Project site.

C. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 P R O D U C T S

2.01 SYSTEM DESCRIPTION

A. Provide RCCB with following performance:

1. Minimum 7 percent cement.

2. Minimum compressive strength: 650 psi at 14 days following TxDOT Tex-120-E.

3. Prepare concrete product in on-site or off-site pug mill, or in on-site or off-site portable concrete mixer.

B. Preliminary Design: Prepare preliminary mix with minimum cement to crushed concrete ratios of 5 percent by dry mass of materials.

1. Designate source of concrete for crushing. Follow Section 01454 - Testing Laboratory Services for tests of concrete from source.

2. Results of laboratory and compression tests will be used by Project Manager to select final mix design.

2.02 PORTLAND CEMENT

A. ASTM C 150 Type I, II, or III; bulk or sacked.

2.03 WATER

A. Potable.

2.04 AGGREGATE

A. Recycled Crushed Concrete: Material retained on No. 40 Sieve, and durable coarse particles of crusher-run reclaimed cured Portland cement concrete, obtained from approved source. Organic material is prohibited. The crushed concrete shall be substantially free of foreign matter including but not limited to asphalt, base, and dirt.

B. Soil Binder (classified below): Meeting following requirements when tested following TxDOT Tex-106-E:

1. Maximum liquid limit: 35

2. Maximum plasticity index: 10

C. Mixed Aggregate and Soil Binder: Grading following TxDOT Tex-101-E and Tex-110-E within following limits:

	Sieve	Percent Crushed Concrete Retained
1.	1 3/4 inch	0 to 10
	No. 4	45 to 75
	No. 40	55 to 80; classified as Soil Binder

2. Bank sand may be added to mix at pug mill.

2.05 ASPHALTIC SEAL CURE

A. Acquire written approval from Project Manager before curing and before proceeding with curing.

B. Use following as option to curing by sprinkling:

1. Cut-back asphalt: MC30 following Section 02742 - Prime Coat.

2. Emulsified petroleum resin: EPR-1 Prime following Section 02742 - Prime Coat.

2.06 MATERIAL MIX

A. Design mix for minimum compressive strength of 650 psi at 14 days following TxDOT Tex- 120-E unconfined compressive strength.

B. Cement Ratio: Follow Paragraph 2.01A. Increase cement content in two percent steps up to 9 percent maximum when compressive strength of design mix samples fail TxDOT Tex- 120E test.

2.07 MIXING EQUIPMENT

A. Mix following Paragraph 2.01A, with metering devices adding specified quantities of crushed concrete, cement, and water into mixer. Dry mix crushed concrete and cement prior to adding water. Produce homogeneous and uniformly mixed product.

2.08 SOURCE QUALITY CONTROL

A. Test following Section 01454 -Testing Laboratory Services.

B. When directed by Project Manager, test for unconfined compressive strength following Test Method TxDOT Tex-120-E as follows:

1. Mold minimum of three samples each day or for each 500 tons of production or one for each day.

2. Compressive strength: average of 3 specimens for each sample lot.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Follow Section 01452 - Inspection Services.

B. Verify buried utility work is complete.

C. Verify lime treatment of base is complete.

D. Verify sub grade is ready to support imposed loads.

E. Verify flatwork, foundations, projecting reinforcement and similar Work interfacing with base is in place.

F. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare sub grade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation, or Section 02336 - Lime Stabilized Sub grade and Section 02337 - Lime-Fly Ash Stabilized Sub grade and Section 02338 - Portland Cement Stabilized Sub grade.

C. Correct sub grade deviations in excess of plus or minus 1/4 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient sub grade in advance of base course for efficient operations.

E. Have sufficient products and equipment on hand to expeditiously apply base.

3.03 MIXING

A. Maintain moisture content of between optimum and 5 percent above optimum.

3.04 PLACEMENT

A. Place mixture with approved spreading equipment. Spread to eliminate planes of weakness or pockets of nonuniformly graded material resulting from hauling and dumping operations.

B. Provide approximately vertical construction joints between fresh base and base-in-place 4 hours or longer. Form joint with temporary header or make vertical cut of in-place base immediately before placing fresh base.

C. Make cold joints at center line of head-to-head parking stalls.

D. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Provide proper bond between reinforcement and base.

E. Transverse and longitudinal joints shall be vertical.

F. Unless noted otherwise, place recycled crushed concrete base in courses not to exceed 8 inches in depth. All courses shall be placed on same working day unless approved by Project Manager. Construction joints between new base and base previously placed shall be wetted and coated with dry cement prior to addition of new base.

G. Complete finishing operations within period of 6 hours after cement is added to base materials.

3.05 COMPACTION

A. Start compaction maximum 3 hours after start of mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow base to mix with underlying material.

1. Do not rework uncompacted material that has set up for more than 30

minutes.

2. Complete placement and compaction work within 6 hours from start of moist mixing.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 5 percent above optimum moisture.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers or flat wheel rollers which are sufficiently light to prevent surface hair line cracking.

F. Compact to minimum density of 95 percent of dry density, following TxDOT Tex -113-E, at moisture content of treated material between optimum and 5 percent above optimum.

G. Test roadway base course compaction in accordance with TxDOT Tex-115-E.

H. Maintain surface to required lines and grades throughout operation.

3.06 CURING

A. Moist cure for minimum of 72 hours before adding pavement courses.

B. Use sprinkling or, at option, apply following curing membrane as soon as initial set begins, using approved light-weight self-propelled pressure distributor:

1. MC30: 0.1 gallon per square yard.

2. EPR-1 Prime: 0.15 gallon of asphalt residual per square yard.

C. Do not use cut-back asphalt during period of April 16 through September 15.

3.07 TOLERANCES

A. Completed Surface: Smooth and conform to typical section and established lines and grades.

B. Top Surface of Base Course: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.08 FIELD QUALITY CONTROL

A. Test following Section 01454 - Testing Laboratory Services.

B. Perform compaction tests following TxDOT Tex-113-E at randomly selected locations. Remove and replace areas failing compaction requirements at no additional cost to City.

3.09 PROTECTION

A. Maintain base in proper condition until surface is placed. Surface must be placed within 14 days after final mixing and compaction unless otherwise approved by Project Manager. Repair unacceptable base course immediately by replacing base to full depth.

B. Curing membrane may remain in place at areas where surface courses or other base courses are applied.

C. Prevent construction traffic on base for minimum 3 days. Light vehicles, used to maintain proper cure, are permitted on base after initial set or as permitted by Project Manager.

END OF SECTION

Section 02714

FLEXIBLE BASE COURSE FOR TEMPORARY ROADS, DETOURS, SHOULDERS, AND DRIVEWAYS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of crushed concrete or stone.

1.02 UNIT PRICES

A. Measurement for flexible base is on a square yard basis. Separate measurement will be made for each different required thickness of base course.

B. Refer to Section 01290 - Payment Procedures for unit price ` procedures.

1.03 REFERENCES

A. ASTM D 1556 - Density of Soil in Place by the Sand-Cone Method.

B. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44 ft-lbf/ft3).

C. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in

Place by Nuclear Methods (Shallow Depth).

D. ASTM D 361 - Test Method for Water Content of Soils and Rock in Place by Nuclear Methods (shallow depth).

E. ASTM D 3017 - Test Method for Water Content of Soils and Rock in Place by Nuclear Methods.

F. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing. H. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittals Procedures.

B. Submit samples of flexible base course and soil binder for testing.

1.05 TESTS

A. Tests and analysis of soil materials will be performed in accordance with ASTM C 131, ASTM D 698, ASTM D 4318, Tex-101-E, and Tex-110-E under provisions of Section 01454 - Testing Laboratory Services.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide materials from stockpiles that are protected during storage from contaminates that would be detrimental to the flexible base course.

B. Load materials from same area of stockpile to maintain uniformity of each successive delivery to the project site.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Crushed Stone or Concrete: Material retained on the No. 40 sieve meeting the following requirements:

1. Durable particles of crusher-run broken limestone, crushed concrete, crushed sandstone, or granite obtained from an approved source.

B. Soil Binder: Material passing the No. 40 sieve meeting the following requirements when tested in accordance with ASTM D 4318:

1. Maximum Liquid Limit: 40

2. Maximum Plasticity Index: 12

3. Maximum Lineal Shrinkage: 7 (when calculated from volumetric shrinkage at liquid limit).

C. Mixed Materials shall meet the following requirements:

1. Minimum compressive strength of 35 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure using triaxial testing procedures.

2. Grading in accordance with Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Retained
1-3/4 inch	0 to 10
No. 4	45 to 75
No. 40	60 to 85

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

C. Complete backfill of new utilities below future grade.

D. Prepare subgrade in accordance with requirements of Section 02230 - Embankment and Section 02315 - Roadway Excavation or Sections 02336 - Lime Stabilized Subgrade and 02337 - Lime/Fly-ash Stabilized Subgrade.

E. Correct subgrade deviations in excess of plus or minus 1/2 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

F. Prepare sufficient subgrade in advance of base course operations.

3.03 PLACEMENT

A. Spread and shape in lifts to compacted thickness not to exceed 6 inches in depth. Complete spreading, shaping, and compacting on same day material is deposited.

B. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure a firm bond between reinforcement and base.

C. Start rolling operations as soon as possible after placement. Use sheepfoot, steel, or pneumatic rollers as approved. Roll longitudinally with subgrade starting from sides. Overlap successive strips by one-half width of each rear wheel.

D. Maintain moisture between optimum and 3 percent above optimum moisture.

E. Compact to 95 percent of Proctor density in accordance with ASTM D 698, unless otherwise indicated on the Drawings.

F. Finish to grade and compact lift before placing successive lift.

G. Maintain shape by grading throughout operation.

H. Provide total thickness indicated on Drawings.

3.04 TOLERANCES

A. Completed surface shall be smooth and conform to typical section and established lines and grades.

3.05 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Compaction Testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM 3017 at a random location near each depth determination core. Rework and recompact areas that do not conform to compaction requirements.

3.06 PROTECTION

A. Sprinkle to prevent excessive loss of moisture.

B. Restrict construction traffic on finished base to equipment required to complete the work.

END OF SECTION

Section 02741

ASPHALTIC CONCRETE PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Surface course of compacted mixture of coarse and fine aggregates and asphaltic binder.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hot-mix asphalt concrete pavement is on a per ton basis. Separate pay items are used for each different required thickness of pavement.

2. Payment for hot-mix asphalt concrete pavement includes payment for associated work performed in accordance with Section 02743 - Tack Coat.

3. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.

4. Payment for temporary detour pavement is on a square yard basis and includes surface and base materials, associated grading, maintenance and removal as well as restoration of ditches.

5. Payment for speed humps is on linear foot basis, and includes milling of existing pavement, tack coat, and placement and compaction of asphalt. Measurement of speed hump is along length of 12 foot wide speed hump, measured transverse to centerline of road. Separate payment is made for thermoplastic markings applied to speed hump.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils

D. TxDOT Tex-126-E - Molding, Testing, and Evaluating Bituminous Black Base Material.

E. TxDOT Tex-200-F - Sieve Analysis of Fine and Course Aggregates.

F. TxDOT Tex-203-F - Sand Equivalent Test.

G. TxDOT Tex-204-F - Design of Bituminous Mixtures.

H. TxDOT Tex 206-F - Compacting Test Specimens of Bituminous Mixtures.

I. TxDOT Tex-207-F - Determining Density of Compacted Bituminous

Mixtures.

J TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

K. TxDOT Tex-217-F - Determining Deleterious Material and Decantation Test for Coarse Aggregates.

L. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

M. TxDOT Tex-530-C - Effect of Water on Bituminous Paving Mixtures.

N. TxDOT Tex-531-C - Prediction of Moisture Induced Damage to Bituminous Paving Materials Using Molded Specimens.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates that asphalt materials and aggregates meet requirements of Paragraph 2.01, Materials.

C. Submit proposed design mix and test data for surface course.

D. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Coarse Aggregate:

1. Use gravel, crushed stone, or combination thereof, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic or other injurious matter occurring either free or as coating on aggregate. Use aggregate conforming to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

2. Aggregate by weight shall not contain more than 1.0 percent by weight of fine dust, clay- like particles, or silt when tested in accordance with Tex-217-F, Part II.

B. Fine Aggregate: Sand, stone screenings or combination of both passing No. 10 sieve. Use aggregate conforming to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by TxDOT Tex- 106-E. Sand equivalent shall have minimum value of 45 when tested by TxDOT Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with TxDOT Tex-200-F. Use type specified on Drawings:

GRADATION OF COMPOSITE AGGREGATE		
	PERCENT PASSING	
SIEVE SIZE	**Course Surface**	**Fine Surface**
7/8"	100	---
5/8"	95 to 100	---
1/2"	--	100
3/8"	70 to 85	85 to 100
#4	43 to 63	50 to 70
#10	30 to 40	32 to 42
#40	10 to 25	11 to 26
#80	3 to	4 to
#200	1 to 6*	1 to 6*
VMA % minimum	13	14
* 2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis)		

D. Asphalt Binder: Moisture-free homogeneous material which will not foam when heated to 347 F, meeting the following requirements. .

PERFORMANCE GRADED BINDER	
CRITERIA / TEST	PERFORMANCE GRADE (PG64-22)

Average 7-day Maximum Pavement Design Temperature, C	< 64
Minimum Pavement Design Temperature, C	> -22
ORIGINAL BINDER	
Flash Point Temperature, T48; Minimum C	230
Viscosity, ASTM D 4402; Maximum, 3Pa*s (3000 cP) Test Temperature, C	135
Dynamic Shear, TP5; G*/sin[ ], Minimum, 1.00 kPa Test Temperature @ 10 rad/sec., C	64
ROLLING THIN FILM OVEN (T240) OR THIN FILM OVEN (T179) RESIDUE	
Mass Loss, Maximum , %	1.00
Dynamic Shear, TP5; G*/sin [ ], Minimum, 2.20 kPa Test Temperature @ 10 rad/sec., C	64
PRESSURE AGING VESSEL RESIDUE (PP1)	
PAV Aging Temperature, C	100
Dynamic Shear, TP5; G*/sin [ ], Minimum, 5000 kPa Test Temperature @ 10 rad/sec., C	25
Physical hardening	Report
Creep Stiffness, TP1; S, Maximum, 300 Mpa -value, Minimum, 0.300 Test Temperature @ 60 sec., C	-12
Direct Tension, TP3; Failure Strain, Minimum, 1.0% Test Temperature @ 1.0 mm/min, C	-12

E. Anti-stripping Agent:

1. Evaluate mixture of aggregate, asphalt, and additives proposed for use for moisture susceptibility and requirement for anti-stripping agents. To substantiate mix design, produce and test trial mixtures using proposed project materials and equipment prior to placement. Test for susceptibility to moisture and trial mixture may be waived by Project Manager when similar designs using same material have previously proven satisfactory.

2. Liquid Anti-stripping Agent. Use anti-stripping agent with uniform liquid with no evidence of crystallization, settling, or separation of components. Submit sample of anti- stripping agent proposed for use and manufacturer's product data, including recommended dosage range, handling and storage, and application instructions.

F. Pavement markings for speed humps: Conform to requirements of Section

02767 - Thermoplastic Pavement Markings.

2.02 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuous mixtures meeting specifications. With exception of a drum mix plant, plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors.

B. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device

2. Dryer

3. Screens

4. Aggregate weight box and batching scales

5. Mixer

6. Asphalt storage and heating devices

7. Asphalt measuring devices

8. Truck scales

B. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix. Provide one cold feed bin per stockpile.

2.03 MIXES

A. Employ certified testing laboratory to prepare design mixes. Test in accordance with TxDOT Tex-126-E or Tex-204-F, Tex-206-F, Tex-208-F, Tex-530-C and Tex-531-C.

B. Density, Stability and Air Void Requirements:

Percent Density		Percent Stability Percent Optimum	HVEEM Not Less Than
94.5	97.5	96	35

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base course is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Tack Coat: Conform to requirements of Section 02743 - Tack Coat. Where mixture will adhere to surface on which it is to be placed without use of tack coat, tack coat may be eliminated when approved by Project Manager.

B. Prepare subgrade in accordance with requirements of Section 02711 - Hot Mix Asphalt Base Course, Section 02712 - Cement Stabilized Base Course, or Section 02713 - Recycled Crushed Concrete Base Course.

C. Prepare subgrade in advance of asphalt concrete paving operation.

D. Perform pavement repair and resurfacing as indicated in Section 02951 - Pavement Repair and Resurfacing.

E. Do not use cutback asphalt.

G. Milling of pavement for speed humps: Mill pavement (concrete or asphalt) to depth of one inch and width between 18 and 24 inches around entire perimeter of proposed hump, as shown in detail for speed hump design.

3.03 PLACEMENT

A. Do not place asphalt pavement less than 2 inches thick when surface temperature taken in shade and away from artificial heat is below 50 F and falling. Asphalt may be placed when temperature is above 40 F and rising.

B. Haul prepared and heated asphaltic concrete mixture to project in tight vehicles previously cleaned of foreign material. Mixture temperature shall be between 250 F and 325 F when laid.

C. Spread material into place with approved mechanical spreading and finishing machine of screening or tamping type.

D. Surface Course Material: Surface course 2 inches or less in thickness may be spread in one lift. Spread lifts in such a manner that, when compacted, finished course will be smooth, of uniform density, and will be to section, line and grade as shown. Place construction joints on surface courses to coincide with lane lines or as directed by Project Manager.

E. Joints: Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

F. When new asphalt is laid against existing or old asphalt, saw cut existing or old asphalt to full depth to provide straight smooth joint.

G. In smaller restricted areas where use of paver is impractical spread material by hand. Compact asphalt by mechanical means. Carefully place materials to avoid segregation of mix. Do not broadcast material. Remove lumps that do not break down readily.

3.04 COMPACTION

A. Construct test strip to identify correct type, number, and sequence of rollers necessary to obtain specified in-place density or air-voids when directed by the Project Manager. Prepare test strip at least 1,000 feet in length, comparable to placement and compaction conditions
for Project.

B. Begin rolling while pavement is still hot and as soon as it will bear roller without shoving, displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water or petroleum by-products.

C. Compact surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing a minimum of 8 tons. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mat temperature drops below 185 F.

D. Use tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.

E. Along walls, curbs, headers and similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

F. Compact binder course and surface course to a minimum density of 91 percent of maximum possible density of voidless mixture composed of same materials in like proportions.

3.05 TOLERANCES

A. Furnish templates for checking surface in finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/8 inch.

B. Completed surface, when tested with 10 foot straightedge laid parallel to center line of pavement, shall show no deviation in excess of 1/8 inch in 10 feet. Correct surface not meeting this requirement.

C. Dimensions of speed humps shall conform to details for speed hump design and speed hump height tolerances.

3.06 QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing

Laboratory Services.

B. For in-place depth and density, take minimum of one core at random locations for each 1000 feet of single lane pavement. On a 2-lane pavement, take samples at random every 500 feet from alternating lanes. Take cores for parking lots every 500 square yards of base to determine in-place depth and density. If cul-de sac or streets are less than 500 feet, minimum of 2 cores (one per lane) will be procured. On small projects, take a minimum of two cores for each day's placement. For first days placement and prior to coring, minimum of 5 nuclear gauge readings will be performed at each core location to establish correlation between nuclear gauge (wet density reading) and core (bulk density). This process will continue for each day's placement until engineer determines that a good bias has been established for that nuclear gauge.

C. Determine in-place density in accordance with TxDOT Tex-207-F and Tex-227-F from cores or sections. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Project Manager. Average densities for each street placed in a single day to determine compliance.

D. Contractor may request three additional cores in vicinity of cores indicating nonconforming in-place depths or density at no additional cost to City. In-place depth and density at these locations shall be average of four cores.

E. Fill cores and density test sections with new compacted asphaltic concrete.

F. Speed humps: Measure dimensions of completed speed hump, before applying pavement markings, at locations shown on Speed Hump Height Measurement Worksheet. Complete one worksheet for each speed hump, and send completed worksheets to City of Houston, Department of Public Works and Engineering, Traffic Management and Maintenance Branch, P.O. Box 1562, Houston, Texas, 77251-1562.

3.07 NONCONFORMING PAVEMENT

A. Recompact and retest nonconforming street sections not meeting surface test requirements or having unacceptable surface texture. Patch asphalt pavement sections in accordance with procedures established by Asphalt Institute. Retesting is at no cost to the City.

B. Remove and replace areas of asphalt surface found deficient in thickness by more than 10 percent. Use new asphaltic surface of thickness shown on Drawings. Remove and replace areas of asphalt surface found deficient in average density.

C. Replace speed humps which do not conform to requirements of details, or which are rejected by Project Manager.

3.08 PROTECTION

A. Do not open pavement to traffic until completion of rolling and temperature has

cooled to set asphaltic concrete surface, or as shown on Drawings.

B. Maintain asphalt pavement in good condition until completion of Work.

C. Repair defects immediately by replacing asphalt pavement to full depth.

3.09 PAVEMENT MARKINGS FOR SPEED HUMPS

A. Apply pavement markings to speed humps in conformance with dimensions shown on detail for speed hump design.

END OF SECTION

Section 02741S

MILLING EXISTING PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Milling of existing asphalt surfacing from an underlying Portland cement concrete pavement or existing asphalt base.

1.02 UNIT PRICES

A. Measurement for milling existing asphalt pavement is on a square yard basis.

B. Refer to Section COH specifications 01270 - Measurement and Payment for unit price procedures.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 GENERAL

A. All asphalt material shall be removed, leaving a uniform surface of Portland cement concrete or existing base.

3.02 PREPARATION

A. Prior to and after the milling process, all dirt and foreign material shall be removed from the pavement surface by power brooming or other approved methods.

3.03 EQUIPMENT

A. The existing material to be removed shall be milled by means of rotary

cutting blades, until it is broken into particles small enough to be removed.

3.04 WASTE MATERIAL DISPOSAL

A. Care shall be taken to prevent millings from entering inlets and storm sewers. All material entering inlet and storm sewer shall be cleaned by Contractor.

B. Dispose of waste material in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02742

PRIME COAT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Prime coat for asphalt concrete paving

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for prime coat under this Section. Include payment in unit price for material being primed.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed prime coat.

C. Submit report of recent calibration of distributor.

PART 2 P R O D U C T S

2.01 CUTBACK ASPHALT

A. Provide moisture-free homogeneous material which will not foam when heated

to 347 degrees F and which meets following requirements:

B. Asphalt material for prime coat shall be MC-30 or MC-70 and shall meet following requirements:

PR	TYPE - GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
Water, Percent	---	0.2	---	0.2
Flash Point, T.O.C., °F	100	---	100	---
Kinematic Viscosity at 140°F, cst	30	60	70	140

1. Distillate shall be as follows, expressed as percent by volume of total distillate to 680 degrees F:

TEMPERATURE	TYPE-GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
to 437°F	---	25	---	20
to 500°F	40	70	20	60
to 600°F	75	93	65	90
Residue from 680°F Distillation,	50	---	55	---

2. Tests on Distillation Residue:

T	TYPE-GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
Penetration at 77°F, 100g, 5 sec.	120	250	120	250
Ductility at 77°F, 5 cm/min. cms	100*	---	100*	---
Solubility in Trichloroethylene, %	99	---	99	---
Spot Test	All Negative			

3.* If penetration of residue is more than 200 and ductility at 77 degrees F is

less than 100 cm, material will be acceptable when its ductility at 60 degrees F is more than 100.

2.02 EMULSIFIED PETROLEUM RESIN

A. EPR-1 Prime: Slow curing emulsion of petroleum resin and asphalt cement conforming to following requirements:

PROPERTIES	MIN.	MAX.
Fural Viscosity at 77(F, Sec	14	40
Residue by Evaporation, % by Weight	60	-
Sieve Test, %	-	0.1
Particle Charge Test	Positive	
Tests on Distillation Residue:		
Flash Point, COC (F)	400	-
Kinematic Viscosity @ 140 F (cst)	190	350

B. For use, EPR-1 may be diluted with water up to maximum three parts water to one part EPR-1 in order to achieve desired concentration of residual resin/asphalt to facilitate application.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course surface of loose material by brooming prior to application of tack coat.

B. Prepare sufficient base in advance of paving for efficient operations.

3.03 APPLICATION, BASIC

A. Apply prime coat with approved type of self-propelled pressure distributor. Distribute prime coat evenly and smoothly under pressure necessary for proper distribution.

B. Keep storage tanks, piping, retorts, booster tanks, and distributors used in handling asphalt materials clean and in good operating condition. Conduct operations so asphalt material does not become contaminated.

C. If yield of asphaltic material appears to be in error, recalibrate distributor prior to

continuing work.

D. Maintain surface until Work is accepted by City.

3.04 APPLICATION, CUTBACK ASPHALT

A. Do not use cutback asphalt during period of April 16 through September 15.

B. Do not place prime coat when air temperature is below 60 degrees F and falling. Materials may be placed when air temperature taken in shade and away from artificial heat is above 50 degrees F and rising.

C. Distribute at rate of 0.25 to 0.35 gallons per square yard.

D. Equipment shall accurately determine temperature of asphaltic material in heating equipment and in distributor, for determining rate of application, and for obtaining uniformity at junction of two distributor loads. Maintain in accurate working order, including recording thermometer at storage heating unit.

E. Base temperature of application on temperature-viscosity relationship that will permit application of asphalt with viscosity of 100 to 125 centistokes. Maintain asphalt within 15 degrees F of temperature required to meet viscosity. Selected temperature shall be within following range.

Prime Coat Type	Minimum (°F)	Maximum (°F)
MC-30	70	150
MC-70	125	175

F. Do not allow temperature of MC-30 to exceed 175 degrees

G. Do not allow temperature of MC-70 to exceed 200 degrees.

3.05 APPLICATION, EMULSIFIED PETROLEUM RESIN

A. Do not place prime coat when air temperature is below 36 degrees F and falling.

B. Distribute at rate of 0.15 to 0.25 gallons per square yard.

3.06 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied prime coat until authorized by Project Manager.

END OF SECTION

Section 02743

TACK COAT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Tack coat for asphalt concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for tack coat under this Section. Include payment in unit price for asphaltic pavements.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 244 - Standard Test Methods for Emulsified Asphalts.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed tack coat.

C. Submit report of recent calibration of distributor.

PART 2 P R O D U C T S

2.01 EMULSION

A. Provide homogeneous material which shows no separation of asphalt after mixing and meets viscosity requirements within 30 days after delivery.

B. Emulsion material for tack coat.

1. Emulsified asphalt: SS-1 or SS-1h meeting following criteria:

PROPERTIES	**SS-**		**SS-**	
	MIN.	**MAX.**	**MIN.**	**MAX.**
Furol Viscosity at 77°F, sec.	20	100	20	100
Residue by Distillation, %	60	--	60	--

Oil Portion of Distillate, %	--	1/2	--	1/2
Sieve Test, %	--	0.10	--	0.10
Miscibility (Standard Test)	Passin			
Cement Mixing, %	--	2.0	--	2.0
Storage Stability, 1 Day, %	--	1	--	1
Test on Residue: Penetration at 77°F, 100g, 5 sec. Solubility in Trichloroethylene, %	120 97.5 100	160 -- --	70 97.5 80	100 -- --

2. Polymer Modified Emulsion, SS-1P, for use where thin overlays (less than or equal 2 inches) are placed on collector or arterial streets and for speed humps, especially over existing Portland cement concrete pavement.

PROPERTIES	SS-	
	MIN.	MAX.
Furol Viscosity at 77 F, sec.	30	100
Residue by Distillation, %	60	--
Oil Portion of Distillate, %	--	1/2
Sieve Test, %	--	0.10
Miscibility (Standard Test)	Passin	
Cement Mixing, %	--	2.0
Storage Stability, 1 Day, %	--	1
Test on Residue: Penetration at 77°F, 100g, 5 sec.; Solubility in Trichloroethylene, %Ductility at 77°F, 5 cm/min., cms; Viscosity at 140	100 97 50 1300	140 -- -- --

3. For emulsions used for tack coats during period of April 16 through September 15, volatile organic compound solvents (VOC) shall not exceed 12 percent by weight when tested in accordance with ASTM D 244.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course or concrete surface of loose material by brooming prior to tack coat application.

3.03 APPLICATION

A. Apply tack coat uniformly by use of approved distributor at rate not to exceed 0.05 gallons per square yard of surface depending on texture of underlying surface. Select an application rate that will provide appropriate asphalt residual.

B. Paint contact surfaces of curbs, structures, and joints with thin uniform coat of tack coat.

3.04 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied tack coat until authorized by Project Manager.

END OF SECTION

SECTION 02744S

EMULSIFIED ASPHALT SLURRY SEAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. A. The installation of a polymer modified emulsion slurry surface consisting of properly proportioned and mixed mineral aggregate, asphalt emulsion and water, spread evenly on a pavement surface, as specified herein and as directed by the Engineer. The slurry, when cured shall bare a homogenous appearance, fill all cracks, and adhere firmly to the adjacent surface, and have a skid resistant texture.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Measurement for polymer modified emulsion aggregate slurry is on a square yard basis. This price shall be full compensation for furnishing

all materials, for preparing, mixing and applying these materials and for all labor, equipment, tools, and incidentals necessary to complete the work.

B. Stipulated Price (Lump Sum). When the Contract is Stipulated Price Contract, payment fir Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASHTO T27: Standard Method for Sieve Analysis of Fine and Course Aggregate.

B. AASHTO T2: Sampling Mineral Aggregates.

C. AASHTO T11: Materials Finer than No. 200 in Mineral Aggregate.

D. AASHTO 176: Sand Equivalent Value of Soils and Fine Aggregate.

E. AASHTO T84: Specific Gravity and Absorption of Fine.

F. AASHTO T19: Unit Weight Aggregate.

G. AASHTO T96: Resistance to Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine.

H. AASHTO T37: Sieve Analysis of Mineral Filler.

I. AASHTO T40: Sampling Bituminous Materials.

J. AASHTO T59: Testing Emulsified Asphalt.

K. AASHTO M140: Specification for Emulsified Asphalt.

L. AASHTO T49: Penetration 100 gm at 5 sec. 77°F(25°C).

M. ASTM D242: Mineral Filler for Bituminous Paving Mixtures

1.04 DEFINITIONS

A. *The slurry seal shall consist of a mixture of an approved emulsified asphalt, polymer modifier , mineral aggregate, water and specified additives, proportioned, mixed and uniformly spread over a properly prepared surface. The completed slurry seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a friction resistant surface texture throughout its service life.*

1.05 SUBMITTALS

A. Mix Design: Submit each proposed mix design 14 days prior to use in the Work. Submittals shall conform to requirements of Section 01300 – Submittals.

B. Submit proposed mix design in accordance with paragraph 2.06.

PART 2- PRODUCTS

2.01 EMULSIFIED ASPHALT

A. POLYMER MODIFIED EMULSION The emulsified asphalt shall be CQS-1HL, CQS1HP, QS1HL, or QS1HP. The polymer modifier shall be either a solid synthetic rubber or latex material. The polymer modifier shall be combined with the base asphalt or asphalt emulsion at a minimum rate of 3% solids by weight of asphalt prior to loading at the manufacturing plant. The polymer modified emulsion shall be compatible with the mix design developed for the conventional slurry seal.

2.02 AGGREGATES MATERIALS

A. The mineral aggregate shall be manufactured (100% crushed) stone such as granite, slag, limestone, chat, or other high quality aggregate that is free from dirt, organic matter, clay balls, adherent films of clay, dust, or other objectionable matter.

B. The Contractor shall insure that all oversize aggregate and other objectionable matter are removed from the mineral aggregate utilized in the slurry seal mixture. Screening shall be required at the stockpile if there are problems created by oversize materials in the mixture.

2.03 AGGREGATES GRADING BAND LIMITS

A. Gradation Type II will be used unless otherwise specified.

B. The following gradations describe the total percent passing by weight, AASHTO T27, and is based on fine and coarse aggregate having approximately the same bulk specific gravities.

GRADING BAND LIMITS							
Sieve Size	DENSE MIXTURES						Stockpile Tolerance
	Type I		Type II		Type III		
	Min	Max	Min	Max	Min	Max	
3/8"	100		100		100		
# 4	100		90	100	70		+ or 5%
# 8	90	100	65	90	90		+ or 5%
# 16	65	90	45	70	45	70	+ or 5%
# 30	40	65	30	50	28	50	+ or 5%
# 50	25	42	18	30	19	34	+ or 4%
# 100	15	30	10	21	12	25	+ or 3%
# 200	10	20	5	15	7	18	+ or 2%
					5	15	

2.04 AGGREGATES JOB-CONTROL GRADING BAND LIMITS

A. The job mix gradation shall be within the gradation band for the desired type. After the target gradation has been submitted, then the percent passing each sieve shall not vary by more than the stockpile tolerance and still remain within the gradation band.

2.05 MINERAL FILLER

A. Portland Cement, hydrated lime, limestone dust, flyash, Aluminum sulfate, or other approved filler meeting the requirements of ASTM D242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate. The quantity and type of filler, if required, shall be determined by the job mix design. It shall be used for one or more of the following reasons only: to improve the gradation of the aggregate to provide improved stability and workability of the slurry, or the increase the durability of the cured slurry.

2.06 WATER

A. Water for the slurry mixture shall be clear, potable, free from harmful soluble salts, and compatible with the slurry mixture

2.07 MIX DESIGN

A. The mix design shall be made with the same aggregate gradation that the Contractor will provide on the project. Sources of all materials shall be selected prior to the time when the mix design is prepared and the materials are required to be used in the work. Slurry seal mixture shall not be placed until a mix design, submitted by the Contractor, has been approved by the Engineer. The exact proportions of asphalt emulsion, aggregate, mineral filler, additives, and water to be used in the preparation of the slurry seal shall be determined by an approved testing laboratory experienced in slurry seal mix design procedures.

The approved slurry mix shall be a homogeneous mixture, sufficiently stable during the entire mixing/spreading period so that the emulsion does not break, there are no segregation of the fines from the coarse aggregate, and the liquid portion of the mix does not float to the surface. The amount and type of asphalt emulsion to be blended with aggregate shall be determined by the laboratory mix design. The set control additive shall be introduced into the slurry seal mixture by an approved method that will assure uniform distribution and proper control. The exact amount shall be determined by conditions in the field and indicated in the mix design. A minimum amount of water shall be used as necessary to obtain a workable and homogeneous mixture. The slurry seal mixture shall show no signs of uncoated aggregate or premature breaking of emulsion when applied to the pavement surface.

B. The mix design and all slurry seal materials shall be approved by the City Engineer prior to use. The component materials shall be within the following limits:

1. Residual Asphalt
   Type I: 10% 16%
   Type II: 7.5% 13.5%
   Type III: 6.5% 12%
   Based on dry weight of aggregate

2. Mineral Filler 0.5% 2.0%
Based on dry weight of aggregate

3. Additives As needed

4. Water As needed to achieve proper mix consistency

2.06 ADDITIVES

A. Additives may be used to accelerate or retard the breakset of the slurry seal, or improve the resulting finished surface. The quantity and type of set control additive, if required, shall be determined by the job mix design and conform to the applicable sections of ASTM D3910 and ISSA T102. The use of additives in the slurry mix shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the Engineer.

PART 3 EXECUTION

3.01 EQUIPMENT GENERAL

A. All equipment, tools, and machines used in performance of this work shall be maintained in satisfactory working condition.

3.02 MIXING EQUIPMENT

A. Mixing Unit. The slurry seal shall be mixed and applied with a machine designed and manufactured to lay slurry seal with a minimum aggregate capacity of eight (8) cubic yards to reduce the number of transverse joints. The slurry seal mixing machine shall be a continuous flow mixing unit, capable of delivering accurately predetermined proportions of aggregate, asphalt emulsion, and mineral filler (if required) to a revolving spiraled multiblade mixer and of discharging the thoroughly mixed product on a continuous basis. The mixing unit shall be capable of thoroughly blending all ingredients together without violent action. The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device or method of introducing a predetermined proportion of mineral filler to the aggregate. The fines feeder shall be used only when mineral filler is part of the mix design. The mixing machine shall be equipped with a water pressure system and fog type spray bar. The machine shall be capable of mixing materials at preset proportions regardless of the speed of the machine and without changing machine settings. Each mixing unit to be used in performance of the work shall be calibrated prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted, provided it was made during the current calendar year. The documentation shall include an individual calibration of each material at various settings which can be related to the machine metering device(s). Attached to the mixing machine shall be a mechanical squeegee distributor (spreader box) having a rubberlike material in contact with the surface to prevent unwanted egress of slurry. It shall prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. An appropriate mechanical device for lateral distribution of the slurry shall be operated within the spreader box. There shall be a steering device, a flexible strike - off, and a burlap or other approved drag. The spreader box shall be adjustable to widths from eight (8) to fifteen (15) feet to minimize the number of longitudinal joints. Broken slurry seal mixture shall not be allowed to collect in the spreader box or on the flexible strike - off.

3.03 SPREADING EQUIPMENT

A. The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as the final strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variation in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform mat.

3.04 WEATHER LIMITATIONS

A. The slurry seal shall not be applied if either the pavement or air temperature is below 50°F(10°C) and falling, but may be applied when both pavement and air temperature are above 45°F(7°C) and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

3.05 NOTIFICATION AND TRAFFIC CONTROL

A. All homeowners and business affected by the paving shall be notified one day in advance of the surfacing. Should work not occur on the specified day, a new notification will be distributed.

B. Suitable methods shall be used by the contractor to protect the slurry seal from all types of vehicular traffic without damage. Opening to traffic does not constitute acceptance of the work. Traffic control shall in accordance with the MUTCD manual.

3.06 SURFACE PREPARATION

A. Immediately prior to applying the slurry seal the surface shall be cleared of all loose material, oil spots, vegetation, and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing. Any painted stripes or markings on the surface of the pavement to be treated shall be removed. Manholes, valve boxes, drop inlets and other service entrances shall be protected from the slurry seal by a suitable method. The Engineer shall approve the surface preparation prior to surfacing.

B. Cracks wider than ¼ inch shall be cleaned with compressed air, and sealed with a compatible crack sealer prior to applying the slurry seal. Cracks wider than ¾ inch should be pre-filled and sealed with the slurry mixture prior to surfacing. Cracks that show evidence of vegetation shall be cleaned and treated with an approved herbicide. Crack sealing and herbicide treatment are subsidiary to this item.

3.07 APPLICATION

A. The surface shall be prewet by fogging ahead of the slurry spreader box. Water used in prewetting the surface shall be applied at such a rate that the

entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total mixing shall not exceed 2 minutes. Care shall be taken not to overload the spreader box which shall be towed at a slow and uniform rate not to exceed 5 miles per hour. No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry shall be removed from the pavement surface. A sufficient amount of slurry shall be fed into the box to keep a full supply against the full width of the spreader box. The mixture shall not be permitted to overflow the sides of the spreader box. No breaking of the emulsion will be allowed in the spreader box. The finished surface shall have no more than four (4) tear or drag marks greater than ½ inch wide and 4 inches long in any 12 foot by 22 foot section. It shall have no tear or drag marks greater than 1 inch wide and 3 inches long. The finished surface shall have no transverse ripples ¼ inch or more in depth, as measured with a 10 foot straight edge laid upon the surface.

B. The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage of all surface voids and cracks is obtained.

C. No streaks, such as those caused by oversized aggregate shall be left in the finished surface.

D. No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of six inches (6") shall be allowed for overlap of longitudinal lane line joints.

E. Areas which cannot be reached with slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be hand worked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during machine applying process.

F. Care shall be taken to insure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide good appearance.

G. All areas, such as manways, gutters and intersections, shall have the slurry seal removed as specified by the City Engineer. The Contractor shall remove any debris associated with the performance of the work on a daily basis.

H. Rate of Application:

APPLICATION RATE	
Type I	8 - 12#/SY
Type II	12 - 20#/SY
Type III	18 - 30#/SY

I. The longitudinal joint between adjacent lanes shall have no visible lap, pinholes, or uncovered areas. Thick application caused by overlapping shall be smoothed immediately with hand squeegees before the slurry seal mixture breaks. When possible, longitudinal joints shall be placed on lane lines. The Contractor shall provide suitable spreading equipment to minimize the number of longitudinal joints. Overlays that occur at transverse joints shall be smoothed before the slurry seal mixture breaks, so that a uniform surface is obtained.

J. Care shall be taken to insure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections shall be kept straight to provide a good appearance.

3.08 SAMPLING AND TESTING

A. Suitable sized samples of aggregate, asphalt emulsion, and mineral filler (if required) shall be submitted, when requested by the Engineer, for approval not less than ten (10) days before the work starts. All samples of materials shall be supplied by the Contractor at his expense, and all tests necessary to determine conformance with requirements specified shall be performed without cost to the Contractor. Additional samples of materials shall be furnished as directed by the Engineer during progress of the work. The owner will notify the Contractor immediately if any test fails to meet the specifications. If it is established that a satisfactory slurry seal mixture meeting the requirements specified herein cannot be produced from the materials furnished, the materials shall be rejected and the Contractor shall submit new samples.

END OF SECTION

Section 02751

CONCRETE PAVING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Portland cement concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete paving is on square yard basis. Separate pay items are used for each different required thickness of pavement.

2. Payment for concrete paving, high early strength, is on square yard basis.

3. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

5. Refer to Paragraph 3.15, Unit Price Adjustment.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 185 - Standard Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

D. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

E. ASTM C 33 - Standard Specifications for Concrete Aggregates.

F. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

G. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

H. ASTM C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

I. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).

J. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

K. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.

L. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Course Aggregates.

M. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

N. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

O. ASTM C 150 - Standard Specification for Portland cement.

P. ASTM C 174 - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.

Q. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

R. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

S. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete. U. TxDOT Tex-203-F - Sand Equivalent Test.

V. TxDOT Tex-406-A - Material Finer than 75 Fm (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual flexural strength obtained from design mixes at required test ages.

C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.

D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 82. Provide specimens for testing when required by Project Manager.

1.05 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without written permission of Project Manager.

B. Class of aggregate being used may be changed before or during Work with written permission of Project Manager. Comply new class with specifications.

C. Reject segregated aggregate. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

D. Reject aggregates mixed with dirt, weeds, or foreign matter.

E. Do not dump or store aggregate in roadbed.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Portland Cement:

1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.

2. Bulk cement which meets referenced standards may be used when method of handling is approved by Project Manager. When using bulk cement, provide satisfactory weighing devices.

3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by Project Manager.

B. Water: Conform to requirements for water in ASTM C 94.

C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).

1. Maximum percentage by weight of deleterious substances shall not exceed following values:

Item	Percent by Weight of Total Sample Maximum
Clay lumps and friable particles	3.0
Material finer than 75-µm (No. 200) sieve:	
Concrete subject to abrasion	3.0
All Other concrete	5.0
Coal and lignite:	
Where surface appearance of concrete is of Importance	0.5

All other concrete 1.0

In case of manufactured sand, when material finer than 75-µm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 1/2 inch to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1 3/4" sieve	0
Retained on 1 1/2"sieve	0 to 5
Retained on 3/4" sieve	30 to 65
Retained on 3/8" sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test *Method Tex-406-A	1.0 maximum

In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight

Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.

E. Mineral Filler: Type “C” or Type “F” fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementatious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.

F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Project Manager.

H. Reinforcing Steel:

1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.

2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.

3. Provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.

2.02 EQUIPMENT

A. Conform Equipment to requirements of ASTM C 94.

2.03 MIXING

A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.

B. Mix design to produce concrete which will have flexural strength of 500 psi at 7 days and 600 psi at 28 days. Slump of concrete shall be at least 2 inches but no more than 5 inches, when tested in accordance with ASTM C 143.

1. Concrete pavement, including curb, curb and gutter, and saw-tooth curb, shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water-cement ratio maximum 0.57). Determine cement content in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.

2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.

3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.

4. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

C. Use high early strength concrete pavement to limits shown on Drawings. Design to meet following:

1. Concrete Mix: Flexural strength greater than or equal to 500 psi at 72 hours.

2. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.

3. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5 inches, when tested in accordance with ASTM C 143.

4. Other requirements for proportioning, mixing, execution, testing, etc., shall be in accordance with this Section 02751 - Concrete Paving.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base is ready to support imposed loads and meets compaction requirements.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.

B. Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.03 EQUIPMENT

A. Alternate equipment and methods, other than those required by this Section, may be used provided equal or better results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order.

B. Subgrade Planer and Template:

1. Use sub grade planer with adjustable cutting blades to trim sub grade to exact section shown on Drawings. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form, and have strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8 inch. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.

2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8 inch. Fit template with accurately adjustable rods projecting downward at 1 foot intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.

C. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.

D. Hand Finishing:

1. Provide mechanical strike and tamping template 2 feet longer than width of pavement to be finished. Shape template to pavement section.

2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.

E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10 ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3 foot width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.

F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.

G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.

1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.

2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.

3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

3.04 FORMS

A. Side Forms: Use metal forms of approved shape and section. Preferred depth of form is equal to required edge thickness of pavement. Forms with depths greater or less than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1 inch, and further provided that forms of depth less than pavement edge are brought to required edge thickness by securely attaching wood or metal strips to bottom of form, or by grouting under form. Bottom flange of form shall be same size as thickness of pavement. Aluminum forms are not allowed. Forms shall be approved by Project Manager. Length of form sections shall be

not less than 10 feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200 foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. In no case shall base width be less than 8 inches for form 8 inches or more in height. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10 feet in length or curved forms may be used. For curb returns at street intersections and driveways, wood forms of good grade and quality may be used.

B. Form Setting:

1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 feet of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300 feet ahead of mixer or as approved by Project Manager.

2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

3.05 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.

B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.

C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.

D. Secure in required position to prevent displacement during placing and finishing of concrete.

E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required providing rigid pavement sections.

F. Use sufficient number of chairs for steel reinforcement bars to maintain position

of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

3.06 FIBROUS REINFORCING

A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

3.07 PLACEMENT

A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.

B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.

C. Concrete slump during placement shall be 1 to 5 inches, except when using traveling-form paver, slump shall be maximum of 2 inches.

D. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10 feet long.

E. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.08 COMPACTION

A. Consolidate concrete using mechanical vibrators as specified herein. Extend vibratory unit across pavement, not quite touching side forms. Space individual vibrators at close enough intervals to vibrate and consolidate entire width of pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.09 FINISHING

A. Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods.

1. Hand finish with mechanical strike and tamping template in same width as pavement to be finished. Shape template to pavement section shown on Drawings. Move strike template forward in direction of placement, maintaining slight excess of material in front of cutting edge. Make minimum of two trips over each area. Screed pavement surface to required section. Work screed with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.

B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.

C. After completion of straightedge operation, make first pass of burlap drag or transverse broom as soon as construction operations permit and before water sheen has disappeared from surface. Follow with as many passes as required to produce desired texture depth. Permit no unnecessary delays between passes. Keep drag wet, clean and free from encrusted mortar during use.

3.10 JOINTS AND JOINT SEALING

A. Conform to requirements of Section 02752 - Concrete Pavement Joints.

3.11 CONCRETE CURING

A. Conform to requirements of Section 02753 - Concrete Pavement Curing.

3.12 TOLERANCES

A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10 foot straightedge parallel to center of roadway to bridge depressions and touch high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16 inch per foot from nearest point of contact. Maximum ordinate with 10 foot straightedge shall not exceed 1/8 inch. Grind spots in excess of required tolerances to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.13 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Project Manager for high early

strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Minimum compressive strength shall be 3000 pounds per square inch for first two specimens and 3500 pounds per square inch at 28 days.

C. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. Minimum of one 4 inch core will be taken at random locations per 375 feet per 12 feet lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3000 pounds per square inch.

E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in- place depths at no cost to City. In-place depth at these locations shall be average depth of four cores.

F. Fill cores and density test sections with new concrete paving or non shrink grout.

3.14 NONCONFORMING PAVEMENT

A. Remove and replace areas of pavement found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. When measurement of any core is less than specified thickness by more than 10 percent, actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to City.

3.15 UNIT PRICE ADJUSTMENT

A. Unit price adjustments shall be made for in-place depth determined by cores as follows:

1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.

2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.

3. Average depth below 90 percent but greater than 80 percent may be accepted by Project Manager at adjusted Unit Price of:

   a. Unit Price Bid - [2 x (1-ratio) x Unit Price Bid]

   b. ratio equals average core thickness divided by thickness bid upon

   c. 0.9 ratio pays 80 percent of unit price and 0.8 ratio pays 60 percent of unit price.

4. Average depth below 80 percent will be rejected by Project Manager.

3.16 PAVEMENT MARKINGS

A. Restore pavement markings to match those existing in accordance with City of Houston standard specifications and details and Project Manager's requirements.

3.17 PROTECTION

A. Barricade pavement section to prevent use until concrete has attained minimum design strength. Cure barricade pavement section for minimum 72 hours before use. Do not open pavement to traffic until concrete is at least 10 days old. Pavement may be open to traffic earlier provided Contractor pays for testing and additional specimen once 7 day specified strength is obtained. Pavement may be opened when high early strength concrete is used meeting specified 72 hour strength.

B. High early strength concrete may be used to provide access at driveways, street intersections, esplanades and other locations approved by Project Manager.

C. On those sections of pavement to be opened to traffic, seal joints, clean pavement, and place earth against pavement edges before permitting use by traffic. Opening of pavement to traffic shall not relieve responsibility for Work.

D. Maintain concrete paving in good condition until completion of Work.

E. Repair defects by replacing concrete to full depth.

END OF SECTION

Section 02752

CONCRETE PAVEMENT JOINTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for street pavement expansion joints, with or without load transfer, is on linear foot basis.

2. Payment for horizontal dowels is on a unit price basis for each horizontal dowel.

3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.

4. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.

5. Payment will be made for Preformed Expansion Joints on a linear foot basis only when field conditions require that sidewalk be moved adjacent to existing concrete structure (i.e., street, back of curb, etc.).

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

C. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. ASTM D 3405 - Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

E. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for joint sealing compound and proposed sealing equipment for approval.

C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 P R O D U C T S

2.01 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.02 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.03 JOINT SEALING COMPOUND

A. Conform joint sealants to one of sealant classes described in this section.

B. Conform hot-poured rubber-asphalt compound to ASTM D 3405.

C. Two-component Synthetic Polymer.

1. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.

2. Cure sufficiently at average temperature of 25 '' 1 C (77 '' 2 F) so as not to pick up under wheels of traffic in maximum three hours.

3. Performance requirements, when tested in accordance with TxDOT Tex-525-C, shall meet above curing times and requirements as follows:

Cold-Extruded and Cold-Pourable (Self-Leveling) Specifications	
Property	**Requirement**
Penetration, 25 C (77 F) 150 g Cone, 5 s, 0.1 mm (in.), maximum	130

Bond and Extension 50%, -29 C (-20 F), 3 cycles: C Dry Concrete Block C Steel blocks (Primed, if recommended by manufacturer) *Steel blocks shall be used when armor joints are specified	 Pass Pass
Flow at 70 C (158 F)	None
Water content % by mass, maximum	5.0
Resilience: C Original sample, % min. (cured) C Oven-aged at 70 C (158 F), % min.	 50 50
Cold-extruded material only - Cold Flow (10 minutes)	None

After bond and extension test, there shall be no evidence of cracking, separation or other opening that is over 3 millimeters (1/8 inch) deep in sealer or between sealer and test blocks.

4. Provide cold-extruded type for vertical or sloping joints.

5. Provide self-leveling type for horizontal joints.

D. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland cement Concrete Joints. This shall be a single component self-leveling silicone or polyurethane material that is compatible with both asphalt and concrete pavements. The sealer shall not require a primer for bond; a backer rod shall be required which is compatible with the sealant; no reaction shall occur between rod and sealant. When tested in accordance with TxDOT Tex-525-C, self-leveling sealant shall meet following requirements:

Self-Leveling, Low Modulus Silicone or Polyurethane Sealant	
Property	**Requirements**
Tack Free Time, 25 '' 1 C (77 '' 2 F), minutes	120 maximum
Nonvolatile content, % by mass	93 minimum

Tensile Strength and 24 Hour Extension Test: C Initial, 10-day cure, 25 '' 1 C (77 '' 2 F), kPa (psi) C After Water Immersion, kPa (psi) C After Heat Aging, kPa (psi) C After Cycling, -29 C (-20 F), 50%, 3 cycles, kPa (psi) C 24 Hour Extension	 C 21 to 69 (3 to 10) C 21 to 69 (3 to 10) C 21 to 69 (3 to 10) C 21 to 69 (3 to 10) C Pass (All Specimens) After 24 hours, there shall be no evidence of cracking, separation or other opening that is over 3 mm (1/8 in.) deep at any point in the sealer or between the sealer and test blocks.

2.04 LOAD TRANSMISSION DEVICES

A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.

B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.05 SUPPORTS FOR REINFORCING STEEL AND JOINT ASSEMBLY

A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Project Manager.

PART 3 E X E C U T I O N

3.01 PLACEMENT

A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.02 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.03 EXPANSION JOINTS

A. Place 3/4 inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight

joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.04 CONTRACTION JOINTS

A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

3.05 LONGITUDINAL WEAKENED PLANE JOINTS

A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15 feet in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

3.06 SAWED JOINTS

A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of 1/4 inch wide. Maintain depth of one quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.

B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

3.07 JOINTS FOR CURB, CURB AND GUTTER

A. Place 3/4 inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120-foot centers.

3.08 JOINTS FOR CONCRETE SIDEWALKS

A. Provide 3/4 inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 36 feet. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend expansion joint material full depth of slab.

3.9 JOINTS FOR CONCRETE DRIVEWAYS

A. Provide 3/4-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

3.10 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.

B. Use joint sealing equipment in like new working condition throughout joint sealing operation, and be approved by Project Manager. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

A. Maintain joints in good condition until completion of Work.

B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

Section 02753

CONCRETE PAVEMENT CURING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for concrete curing under this Section. Include payment in unit price for Concrete Paving, Concrete Sidewalks, Concrete Driveways, Curbs, and Curb and Gutters.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 156 - Standard Test Method for Water Retention by Concrete Curing Materials.

B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 P R O D U C T S

2.01 COVER MATERIALS FOR CURING

A. Conform curing materials to one of the following:

1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.

2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.

3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitch mats so that mat will contact surface of pavement at all points when saturated with water.

2.02 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m^2 in 72 hours using test method ASTM C 156.

PART 3 E X E C U T I O N

3.01 CURING REQUIREMENT

A. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.

B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.02 POLYETHYLENE FILM CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.

B. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or replacing.

3.03 WATERPROOFED PAPER CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Overlap joints in blankets caused by joining paper sheets not less than 5 inches and securely seal with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure overlap of at least 12 inches. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects.

3.04 COTTON MAT CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.

B. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.05 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

B. Moisten concrete by water fogging prior to application of membrane when surface has become dry.

C. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Project Manager, but not less than one gallon per 200 square feet of surface area.

3.06 TESTING MEMBRANE

A. Treated areas will be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.

B. Reapply membrane compound immediately at no cost to City when membrane fails above test.

END OF SECTION

Section 02761

COLORED CONCRETE FOR MEDIANS AND SIDEWALKS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Colored concrete for medians and sidewalks.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for coloring agent under this Section. Include payment in unit price bid for concrete sidewalks, and concrete medians and directional islands.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed coloring agent.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Coloring Agent: Provide dry-shake color hardener consisting of quartz-silica mixture of finely-graded, non-metallic aggregates, plasticizer and cement binder for producing color as shown on Drawings.

B. Concrete: Conform to material and proportion requirements of Section 02751 – Concrete Paving.

PART 3 E X E C U T I O N

3.01 CONCRETE MEDIANS

A. Install concrete medians in accordance with requirements of Part 3 of Section 02772 - Concrete Medians and Directional Islands with addition of procedure for application of coloring agent as required by Paragraph 3.03, Coloring Agent.

3.02 CONCRETE SIDEWALKS

A. Install concrete sidewalks in accordance with requirements of Part 3 of Section 02775 - Concrete Sidewalks with addition of procedure for application of coloring agent as required by Paragraph 3.03, Coloring Agent.

3.03 COLORING AGENT

A. Apply coloring agent on newly finished concrete surface as soon as job conditions permit, but in no event later than 2 hours after concrete is placed, at rate recommended by manufacturer and approved by Project Manager.

B. Apply color hardener uniformly to surface by dry-shake method when no excess moisture shows at surface of concrete substrate, but while concrete is still plastic throughout. Do not sprinkle or otherwise add water to surface during application or finishing. Necessary moisture for color hardener shall come from concrete substrate in order to develop proper bond and assure adequate density for color-hardened surface.

C. First shake shall consume two-thirds of material. Withhold one-third for second shake and final touch-up. After first shake, float surface thoroughly by mechanical or hand methods. Do not trowel surface between first and second shakes.

D. Apply second shake evenly, then float and trowel surface. Retain small quantity of material from second shake for touching up nonuniform or weak-toned areas. Minimize hard troweling and use consistent finishing practices to ensure uniformity of color.

END OF SECTION

Section 02762

BLAST CLEANING OF PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removal of existing pavement markings.

B. Preparation of pavement surfaces for new pavement markings.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for blast cleaning of roadway lanes is on linear foot basis for each width, measured in place.

2. Payment for blast cleaning of symbols and legends is on square foot basis, measured in place.

3. Payment for removal of raised pavement markings, all types, is on a lump sum basis.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description and characteristics of proposed blasting medium and equipment for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Blasting Media: Quality commercial product capable of producing specified surface cleanliness without deposition of deleterious materials on cleaned pavement surface. Do not use high silica content sand that may result in high levels of free crystalline silica dust particles as blasting agent.

2.02 EQUIPMENT

A. Equipment shall be power driven and of sufficient capacity to remove pavement markings. Equipment shall utilize moisture and oil traps of sufficient capacity to remove contaminants from air and prevent deposition of moisture, oil, or other contaminants on pavement surface.

PART 3 E X E C U T I O N

3.01 REMOVAL OF EXISTING MARKINGS

A. Remove pavement markings where necessary to prevent driver confusion, or where indicated on Drawings. Included are areas where it will be necessary for drivers to cross existing markings which they would not normally cross. Remove or obliterate markings. Do not damage pavement surface.

3.02 CLEANING FOR PLACEMENT OF MARKERS

A. Remove old pavement markings, loose material, and other contaminants deleterious to adhesion of new pavement markings to be placed. On Portland cement concrete pavement, minimize over blasting to prevent damage to pavement surface. Small particles of tightly adhering existing pavement markings may remain when complete removal will result in pavement surface damage.

B. Follow manufacturer's written instructions for proper cleaning of pavement surfaces to receive pavement marking.

END OF SECTION

Section 02767

THERMOPLASTIC PAVEMENT MARKINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. This item includes white thermoplastic pavement markings for crosswalks, stop lines, lane lines, and other types of traffic controls.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for thermoplastic pavement markings is on a linear foot basis.

2. Payment for words and symbols is for each word or symbol.

3. Payment for railroad crossing markings, to include stop line and two

transverse lines, is for each crossing marked.

a. For multi-lane approaches to railroad crossings, the solid 8-inch lane lines will be measured in linear feet, complete in place.

4. Unit price bid for each item full compensation for furnishing and placing all materials, and for all manipulations, including blast cleaning, surface sealing and priming, labor, tools, equipment, and incidentals necessary to complete Work in accordance with drawings and specifications.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM E 28 - Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus.

B. ASTM G 152 - Standard Practice for Operating Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

C. ASTM G 153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

D. TxDOT Tex-822-B - Determining Refraction Index of Glass Beads.

E. TxDOT Tex-826-B - Water Absorption Test of Beads.

F. TxDOT Tex-839-B - Determining Color in Reflective Material.

G. TxDOT Tex-851-B - Evaluating the Abrasion Resistance of Pavement Marking Material.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Product Data: Submit Manufacturer's literature indicating product specifications and instructions for handling, installation, and curing. Include performance test data sheets for each product.

C. Submit material supplier's certification of compliance with specifications.

D. Submit proposed methods, equipment, and sequence of operation for layout, surface preparation, and installation.

E. Chemical Analysis: Submit infrared analysis of Type B resins for each manufacturer used.

PART 2 P R O D U C T S

2.01 MATERIAL REQUIREMENTS

A. General Requirements. Especially compound Type B thermoplastic pavement marking material for use on either asphaltic or Portland cement concrete surfaces. Clearly mark each container to indicate color, weight, type of material, and lot or batch number (consider lot or batch as each individual mix or blend that produces finished product ready for use). Package material in either suitable corrugated containers or thermal degradable plastic bags to avoid sticking during shipment or storage.

B. Thermoplastic markings shall not be slippery when wet, nor exhibit tacky, exposed surface. Cold ductility of material shall permit normal road surface expansion and contraction without chipping or cracking. Markings shall retain their original color, dimensions, and placement under normal traffic conditions at road surface temperatures of 158 F and below.

C. Prime and filler pigments shall pass U.S. Standard sieve No. 230 (0.0024 inch opening) when washed free of resins by solvent washing, and meet following specific requirements for each pigment.

1. Prime Pigments: White pigment shall be Rutile Titanium Dioxide.

2. Filler Pigment: Filler pigment shall be calcium carbonate, 95% purity.

D. Binder

1. Type B - Alkyd: Use binder consisting of mixture of resins, at least one of which is solid at room temperature, and high boiling point plasticizers. At least one-third of binder compositions shall be a maleic-modified glyceryl ester 012 Rosin and shall be no less than 8% by weight of entire material formulation.

F. Glass Traffic Beads: the total silica used in formulation shall be in form of glass traffic beads meeting the following requirements:

1. Manufacture. Use glass traffic beads having the following characteristics:

a. Manufactured from glass;

b. Spherical in shape;

c. Free of sharp angular particles;

d. Free of particles showing milkiness, surface scoring, or surface scratching;

e. Water white in color.

2. Contaminants. Use glass traffic beads having the following characteristics:

a. Containing less than 1/4 of 1% moisture by weight;

b. Free of trash, dirt, etc;

c. Showing no evidence of objectionable static electricity when flowing through regular traffic-bead dispenser.

3. Gradation:

a. Sieve Analysis. Glass traffic beads shall meet following gradation requirements:

Openings U.S. Standard Sieves	Percent Passing
No. 20	95 - 100
No. 30	80 - 95
No. 50	15 - 35
No. 100	0 - 4

b. Irregular Particles: Glass traffic beads, retained on screen used to determine gradation requirements, shall not contain more than 30% (by weight) irregular particles.

4. Index of Refraction: Glass traffic beads, when tested by TxDOT Tex-822-B, using liquid immersion method at 25 C (77 F) shall show index of refraction within range of 1.50 to 1.53.

5. Wetting. Use glass traffic beads capable of being readily wet with water when tested in accordance with TxDOT Tex-826-B.

6. Stability. Use glass traffic beads showing no tendency toward decomposition, surface etching, change in retro reflective characteristics, or change in color after:

a. One hour exposure to concentrated hydrochloric acid at 25 C (77 F);

b. Twenty-four-hour exposure to weak alkali;

c. One hundred hours of Weather-O-Meter exposure, in accordance with ASTM G 152 and ASTM G 153.

2.02 FINISHED PRODUCT REQUIREMENTS

A. Physical Characteristics. Finished thermoplastic pavement markings material shall be free flowing granular material, unless otherwise shown on Drawings. Material shall remain in free flowing state in storage at temperatures of 100 F or less. Materials shall be readily sprayed through nozzles commonly used on thermoplastic spray equipment at temperatures between 205 and 218 C (401 to 425 F).

B. Toxicity. At temperatures up to and including 230 C (446 F), materials shall not give off fumes which are toxic and otherwise injurious to persons, animals, or property.

C. Material shall not break down or deteriorate when held at 205 C (401 F) for 4 hours.

D. Temperature versus viscosity characteristics of material in plastic state shall remain constant throughout up to four reheatings at 205 C (401 F) and from batch to batch.

E. Material shall not be adversely altered by contact with sodium chloride, calcium chloride, or other similar chemicals on, or used on, roadway surface; by contact with oil content of pavement materials, or by contact from oil dropping from traffic.

F. Softening Point. After heating thermoplastic materials for two hours at 204 C (400 F) Type B Alkyd material shall have softening point greater than 90 C (194 F) when tested in accordance with ASTM E 28-58T - Ball and Ring Method.

G. Color. CIE chromaticity coordinates of materials, when determined in accordance with TxDOT Tex-839-B, shall fall within area having following corner points and shall meet following luminosity requirements.

CIE CHROMATICITY COORDINATE CORNER POINTS					
	Point 1	**Point 2**	**Point 3**	**Point 4**	
Color	X Y	X Y	X Y	X Y	Luminosity
White {tc \12 "White }	0.290 - 0.315	0.310 - 0.295	0.350 - 0.340	0.330 - .360	Min 65

Material shall meet above specified color requirements, before and after 70 hours of exposure in Weather-O-Meter (Atlas, Sunshine Type) fitted with 18 - 102 (18 minutes of sunshine and rain and 102 minutes of sunshine) cyclic gear. Prepare panels for testing with material as supplied.

H. Abrasion. Thermoplastic pavement marking materials shall have loss between 4.0 and 12.0 grams when tested for abrasion in accordance with TxDOT Tex-851-B. Test according to steps 1 through 8 of procedure utilizing following test parameters:

Test distance: 5 inches
Blast pressure: 40 psi
Sample angle: 10 degrees and 122 gram blast media
Blast Media: 1200 grams

I. Uniformity. Manufacture material so that, when sampled in accordance with TxDOT Manual of Testing Procedures, 100-gram sample will be representative

of batch or lot of material.

J. When applied 1/8 inch thick, setting time shall not exceed characteristic straight-line curve, lower limit of which is four minutes at 59 F road surface temperatures, and upper limit of which is ten minutes at 90 F road surface temperature. Both temperatures are to be measured at maximum relative humidity of 90%.

2.03 FORMULA

A. Type B - Alkyd Thermoplastic Marking:

	Pounds
Binder	18 - 23
Titanium Dioxide	12 - 15
Calcium Carbonate	20 - 42
Glass Traffic Beads	30 - 45
TOTAL	100

PART 3 E X E C U T I O N

3.01 GENERAL

A. Spray apply pavement marking or extrude hot to pavement surface unless application method is specified on Drawings.

B. Provide continuous mixing and agitation of material. Provide clean, square, marking ends. Do not use pans, aprons, or similar appliances which die overruns.

C. Provide thermometer capable of measuring temperature of pavement marking material.

D. Use automatic bead dispenser attached to pavement marking equipment in manner that beads are dispensed uniformly and almost instantly upon marking as marking is being applied to road surface. Rate of application shall be sufficient to achieve retro-directive reflective characteristics specified. Provide automatic cut-off control for bead dispenser, synchronized with cut-off of pavement marking equipment.

E. Place markings in accordance with approved traffic control plan so that minimal interruption to traffic flow is achieved. Protect newly-installed pavement

markings from damage by traffic.

F. Apply pavement markings onto clean, dry pavement having road surface temperature above 60 F for Portland cement concrete surface and above 50 F for asphaltic surface. When pavement marking application is by spray and operations cease for five or more minutes, flush spray head by spraying pavement marking material into pan or similar container until material is proper temperature for application.

G. Use markings that are completely reflectorized internally and externally.

H. Use crew experienced in work of installing pavement markings and supply all equipment and materials necessary for placement of pavement markings.

I. Apply material within temperature limits recommended by manufacturer.

J. Prior to placement of thermoplastic material, properly prepare pavement with primer.

3.02 LAYOUT

A. Place pavement markings in proper alignment with guidelines established on roadway. Do not deviate from alignment established greater than two inches. Do not deviate in alignment of marking being placed greater than one inch per 200 feet of marking and do not deviate abruption.

B. Place additional markings required to achieve alignment specified throughout both straight and horizontally curved sections of roadway. Additional markings placed on roadway for alignment purposes shall be temporary in nature and shall not establish permanent marking on roadway. Materials used for alignment markings and equipment used to place markings shall be approved by Engineer.

3.03 SURFACE PREPARATION

A. Clean pavement by sandblasting and prepare in accordance with recommendations of thermoplastic material manufacturer and to satisfaction of Engineer, prior to placement of markings. Surface scarification can be used with prior approval of Engineer.

B. Use cleaning methods approved by Engineer that completely remove contaminants, loose materials, and conditions deleterious to proper adhesion. Do not clean Portland cement concrete surfaces by grinding.

C. Prepare Portland cement concrete surfaces further after cleaning by completely sealing with epoxy or methyl methacrylate sealer, as recommended by thermoplastic material manufacturer. Placed sealer sufficiently in advance of thermoplastic to allow release of all solvents.

D. Prime asphaltic surfaces with sealer, as recommended by thermoplastic material manufacturer based on surface conditions. Include adhesive or

adhesion promoter when asphaltic surfaces exhibit polished aggregate.

3.04 INSTALLATION

A. Install in widths of 4, 6, 8, or 12 inches, or shaped otherwise as shown on Drawings. Tolerances in width shall not exceed 1/8 inch. Tolerance shall not exceed 1/4 inch in case of undulation in pavement.

B. Material shall not prohibit adhesion of other thermoplastic markings if, at some future time, new markings are placed over existing materials.

C. Maintain uniform thickness of each pavement marking. Minimum thickness of markings, as measured above plane formed by pavement surface, shall not be less than 1/8 inch (125 mils), unless shown otherwise on Drawings. Maximum thickness shall be 3/16 inch. Supply device, approved by Engineer, to measure thickness of applied extruded markings.

3.05 TESTING

A. Maintain uniform cross section, density, quality, and thickness for markings. Markings shall be uniform throughout their thickness. Use applied markings that are 95% free of holes and voids, and free of blisters for minimum of 60 days after application.

END OF SECTION

Section 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for curbs, curbs and gutter, and esplanade curbs is on linear foot basis measured along face of curb.

2. Payment for 3 foot concrete valley gutter is on a linear foot basis.

3. Payment for mountable concrete curbs is on a square foot basis.

4. Payment for concrete paving headers and concrete railroad headers is on a linear foot basis.

5. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to concrete pavement.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit details of proposed form work for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Grout: Nonmetallic, nonshrink grout containing no chloride producing agents conforming to following requirements.

1. Compressive strength

a. at 7 days: 3500 psi

b. at 28 days: 8000 psi

2. Initial set time: 45 minutes

3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.

F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Project Manager.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.02 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Section 02752 - Concrete Pavement Joints. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4 inch deep using approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.03 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4 inch edger. Finish edges with tool having 1/4 inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall

have uniform color, shape and appearance.

3.04 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Project Manager. Use of mechanical methods shall provide specified curb design and finish.

3.05 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 - Concrete Pavement Curing.

3.06 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.07 PROTECTION

A. Maintain curbs and gutters in good condition until completion of Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

Section 02772

CONCRETE MEDIANS AND DIRECTIONAL ISLANDS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Portland cement concrete medians and directional islands.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete medians and directional islands is on square yard basis measured from back of curbs.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

D. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.

E. Subgrade Materials: Conform to subgrade material requirements of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade and Section 02338 - Portland Cement Stabilized Subgrade.

PART 3 E X E C U T I O N

3.01 SUBGRADE

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill and embankment. Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade and Section 02338 - Portland cement Stabilized Subgrade.

3.02 PLACEMENT OF CONCRETE

A. Place and finish concrete in accordance with applicable portions of Section 02751 – Concrete Paving.

3.03 JOINTS

A. Install joints in accordance with Section 02752 - Concrete Pavement Joints.

3.04 CONCRETE CURING

A. Cure concrete in accordance with Section 02753 - Concrete Pavement Curing.

3.05 PROTECTION

A. Maintain concrete medians and directional islands in good condition until completion of work.

B. Replace damaged concrete medians and directional islands to comply with this Section.

END OF SECTION

Section 02775

CONCRETE SIDEWALKS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete sidewalks is on square foot basis.

2. No payment will be made for work outside these limits or in areas where driveway has been removed or replaced for Contractor's convenience.

3. Payment for wheelchair ramps of each type specified is on square foot basis. Removal and replacement of existing sidewalk, curb or curb and gutter and saw-cutting is paid by unit cost for each item. Sodding will be paid one foot on each side of sidewalk unless otherwise noted. Staining of wheelchair ramps is included in cost of ramp.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in Field.

B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

E. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

F. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

G. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3).

H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statues.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certified testing results and certificates of compliance.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements of Section 02751 - Concrete Paving for reinforcing steel. Use No. 3 reinforcing bars.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. The use of 2 inch by 4 inch lumber as forms will not be allowed.

F. Sand Bed: Conform to material requirements for bank run sand of Section 02320 – Utility Backfill Materials.

G. Sodding: Conform to material requirements for sodding of Section 02922 - Sodding.

H. Coloring for wheelchair ramps: Conform to material requirements for colored concrete of Section 02761 - Colored Concrete for Medians and Sidewalks.

Color shall be Brick Red or as shown on the drawings.

PART 3 E X E C U T I O N

3.01 REPLACEMENT

A. Replace sidewalks and slope paving which are removed or damaged during construction with thickness and width equivalent to one removed or damaged, unless otherwise shown on Drawings. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.

B. Provide replaced and new sidewalks with wheelchair ramps when sidewalk intersects curb at street or driveway.

3.02 PREPARATION

A. Identify and protect utilities which are to remain.

B. Protect living trees, other plant growth, and features designated to remain.

C. Conduct clearing and grubbing operations in accordance with Section 02233 - Clearing and Grubbing.

D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with Section 02336 – Lime-Stabilized Subgrade. Compact subgrade to minimum of 90 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.

E. Immediately after subgrade is prepared, cover with compacted sand bed to depth as shown on Drawings. Lay concrete when sand is moist but not saturated.

3.03 PLACEMENT

A. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4's as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.

B. Reinforcement:

1. Install reinforcing bars.

2. Install reinforcing steel as shown on the drawings. Lay longitudinal bars in walk continuously, except through expansion joints.

3. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.

4. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.

5. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

C. Expansion Joints: Install expansion joints with load transfer units in accordance with Section 02752 - Concrete Pavement Joints.

E. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.

F. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.

G. Apply coating to wheelchair ramp with contrasting color in accordance with Section 02761 - Colored Concrete for Medians and Sidewalks.

H. Unless otherwise indicated on Drawings, mark off sidewalk joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.

I. Finish edges with tool having 1/4 inch radius.

J. After concrete has set sufficiently, refill space along sides of sidewalk to one-inch from top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Section 01576 - Waste Material Disposal. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Section 02951 - Pavement Repair and Resurfacing.

3.04 CURING

A. Conform to requirements of Section 02753 - Concrete Pavement Curing.

3.05 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Compressive Strength Test Specimens: Four test specimens for compressive strength test will be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in one day. Two specimens will be tested at 7 days. Remaining two specimens will be tested at 28 days. Specimens will be tested in accordance with ASTM C 39. Minimum compressive strength: 2500 psi at 7 days and 3000 psi at 28 days.

C. Yield test for cement content per cubic yard of concrete will be made in accordance with ASTM C 138. When cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. If the Contractor places concrete without notifying the laboratory, the City will have the concrete tested by means of core test as specified in ASTM C 42. When concrete does not meet specification, cost of test will be deducted from payment.

E. Sampling of fresh concrete shall be in accordance with ASTM C 172.

F. Take slump tests when cylinders are made and when concrete slump appears excessive.

G. Concrete shall be acceptable when average of two 28 day compression tests is equal to or greater than minimum 28 day strength specified.

H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.

I. If 28 day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Project Manager. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due.

3.06 NONCONFORMING CONCRETE

A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. Replace nonconforming sections at no additional cost to City.

3.07 PROTECTION

A. Maintain newly place concrete in good condition until completion of Work.

B. Replace damaged areas.

END OF SECTION

Section 02911

TOPSOIL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for topsoil under this Section. Include payment in Section 02921 - Hydro-mulch Seeding or Section 02922 - Sodding.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having following characteristics:

1. pH value of between 5.5 and 6.5
2. Liquid limit: 50 or less

3. Plasticity index: 20 or less

4. Gradation: maximum of 10 percent passing No. 200 sieve

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at minimum depth of 4 inches and has similar characteristics to that found at placement site. Do not obtain topsoil from areas infected with growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Excavate topsoil for esplanades and areas to receive grass or landscaping from areas to be further excavated. Stockpile in area approved by Project Manager.

B. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.02 TOPSOIL EXCAVATION

A. Conform to excavation and stockpiling requirements of Section 02315 – Roadway Excavation.

3.03 PLACEMENT

A. Place no topsoil until subgrade has been approved. For areas to be seeded or sodded, scarify or plow existing material to minimum depth of 4 inches, or as indicated on Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with appropriate lawn roller to consolidate topsoil.

B. Increase depth of topsoil to 6 inches when placed over sand bedding and backfill materials specified in Section 02320 - Utility Backfill Material.

C. For areas to receive shrubs or trees, excavate existing material and place topsoil to depth and dimensions shown on Drawings.

D. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Section 01576 - Waste Material Disposal.

E. Place topsoil to promote good drainage and compact with light roller. Water topsoil after placement until saturated for minimum depth 6 inches, fill in and recompact areas of settlement.

3.04 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

Section 02951

PAVEMENT REPAIR AND RESURFACING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Repairing and resurfacing streets, highways, driveways, sidewalks, and other pavements that have been cut, broken, or otherwise damaged during construction.

1.02 MEASUREMENT

AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for pavement repair and resurfacing under this Section. Payment will be in accordance with Measurement and Payment for work as required in appropriate sections.

2. Refer to Section 01270 - Measurement and Payment for other unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Subgrade:

1. Provide backfill material as required by applicable excavation and fill sections (Sections 02315 through 02319) and Section 02330 - Embankment.

2. Provide material for stabilization as required by applicable portions of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and Section 02338 - Portland Cement Stabilized Subgrade.

B. Base: Provide base material as required by applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Crushed Concrete Base Course.

C. Pavement: Provide paving materials as required by applicable portions of Section 02741 - Asphaltic Concrete Pavement, Section 02751- Concrete Paving, Section 02754 - Concrete Driveways, and Section 02771 - Curb, Curb and Gutter, and Headers, and Section 02775 - Concrete Sidewalks.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Notify City prior to commencement of excavation in pavement for which an Excavation in Public Way permits has been obtained. Follow directions contained in the permit.

B. Conform to requirement of Section 02221 - Removing Existing Pavements and Structures, for removals.

C. Saw cut pavement 18 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.

D. When removing pavement to existing deformed metal strip (i.e. dummy joint), saw cut pavement minimum 2 inches deep on opposite side of deformed metal strip. Place saw joint far enough behind deformed metal strip to obtain continuously straight joint. Remove damaged portion of deformed metal strip as required to provide proper joint. Saw cut and remove metal strip before placement of new concrete pavement.

E. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, protect undisturbed subgrade that is to remain to support replacement slab.

F. Dowel in existing pavement where no reinforcement is found or is broken due to construction activities. Unless otherwise directed by Project Manager, provide No. 6 bars 24 inches long, drilled and embedded 8 inches into center of existing slab with 'PO-ROC' epoxy grout or approved equal. Space dowels to match new pavement reinforcement spacing.

G. Provide transitional paving and earthwork as required to tie proposed pavement to existing pavement when unable to dowel new pavement into existing pavement.

3.02 INSTALLATION

A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.

B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings and City of Houston Standard Detail 02951.01. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.

C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings and City of Houston Standard Detail 02751.01. Place types and spacing of joints to match existing or as indicated on Drawings.

D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2 inch depth asphaltic pavement.

E. Repair state highway and county crossings in accordance with TxDOT permit or county requirements as appropriate and within 1 week after utility work is installed.

3.03 WASTE MATERIAL DISPOSAL

A. Dispose of waste material in accordance with requirements of Section 01576 – Waste Material Disposal.

3.04 PROTECTION

A. Maintain pavement in good condition until completion of Work.

B. Replace pavement damaged by Contractor's operations at no cost to City.

END OF SECTION

Section 02983

REMOVAL AND RESTORATION OF BRICK PAVED STREETS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Brick paving work for removal and restoration of existing brick paved streets; either exposed or overlaid is directed toward preservation of historic items.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removal and restoration of brick paved streets is on square yard basis.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 91 - Standard Specification for Masonry Cement.

B. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

C. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification from manufacturer that bricks and masonry cement meet applicable requirements of reference standards.

1.05 HANDLING AND STORAGE

A. Take extreme care when excavating in or adjacent to brick paved surface.

B. Remove bricks by hand and clean them of mortar, grout, sand or tar.

C. Protect brick at work site from theft, breakage, and damage. Store brick on site in secure, locked area.

D. Place cleaned brick on pallets and strap them for delivery to City's storage location at 812 Gillette Street. Place brick in area designated for historically sensitive items, as directed by City Employee at location. Have City Employee sign delivery ticket validating delivery, including quantity of brick stored.

PART 2 P R O D U C T S

2.01 BRICK MASONRY UNITS FOR PAVING

A. Reuse existing bricks in order to restore brick paved surface to its original or better condition.

B. Replace bricks which become damaged or cracked with new paving bricks that match existing brick. Remove damaged bricks from site.

C. Provide replacement paving bricks that match existing brick in dimension, durability, and color. New paving bricks may be obtained from manufacturer which provides antique brick replicas. Antique brick may be purchased from Contractor's source.

2.02 MORTAR

A. Masonry Cement: Cement manufactured in United States and conforming to requirements of ASTM C 91.

B. Mixing Water: Clean, free from harmful amounts of acids, alkalis and organic material.

C. Type and Strength: Comply with requirements of ASTM C 270, Type M, with compressive strength of 2500 psi at 28 days.

D. Brick Foundation Base: Use cement-stabilized sand as specified in Section 02321 – Cement Stabilized Sand.

PART 3 E X E C U T I O N

3.01 RESTORATION OF PAVEMENT FOR OVERLAID BRICK STREETS

A. The restoration of brick pavement section which is below existing overlay is not required. Replacement of pavement after completing utility work can be accomplished without replacing brick. Use paving materials matching existing to restore pavement section. Refer to Section 02951 - Pavement Repair and

Resurfacing.

3.02 PREPARATION FOR RESTORATION OF EXPOSED BRICK STREET

A. Ensure that subgrade to support brickwork is at proper grades and elevation. Correct improperly prepared surfaces. Before starting brick paving work, verify that work surfaces and masonry are free of dirt, grease, oil, or other harmful materials.

B. Excavate and compact backfill according to Section 02317 - Excavation and Backfill for Utilities. Place 6 inches of cement stabilized sand base to elevation of brick foundation in accordance with Section 02716 - Cement Stabilized Sand Base.

3.03 WEATHER REQUIREMENTS

A. Lay no masonry when temperature of outside air is below 40 degrees F, unless satisfactory means are provided to heat materials and protect work from cold and frost.

B. Maintain mortar at 40 degrees F or above and ensure that mortar will harden without freezing.

3.04 MORTAR MIXING

A. Proportion mortar ingredients by methods that will ensure accurate measure. Mix in power- driven, drum-type mixer as follows:

1. Combine 3/4 of required water and all masonry cement.

2. Mix briefly, then add water in small quantities until workability of batch is satisfactory to masons.

3. Mix for minimum of 3 minutes and completely empty drum before recharging for next batch.

B. Retemper mortar that has stiffened because of evaporation of water by adding water as frequently as needed to restore desired consistency. Use and place mortar in final position within 2 1/2 hours after initial mixing.

3.05 BRICK PLACEMENT

A. Ensure that brick foundation base is properly graded and compacted in order to match grade of surrounding existing brick pavement. Provide for proper drainage without ponding.

B. Place bricks level to create smooth and uniform surface for vehicles.

C. Where fresh masonry joins partially set or totally set masonry, clean surfaces of set masonry. Remove loose mortar and brick.

D. Wet brick to obtain best possible bond.

E. Immediately remove mortar droppings and splashing as work progresses to facilitate final cleaning.

3.06 JOINTS

A. Completely fill joints in brick and other materials with mortar as each course is laid.

B. Make joints uniform 3/8 inch wide or match existing joint width, unless otherwise shown on Drawings.

C. When mortar is "thumbprint" hard, tool exposed joints with round jointer that is slightly larger than width of mortar joint. In tooling, make sure that cracks and crevices are closed.

D. Point holes in masonry. Cut out defective joints and repoint.

3.07 FIELD QUALITY CONTROL

A. Test under provisions of Section 01454 - Testing Laboratory Services.

B. Mold minimum of one set of mortar samples for each day's placement, or as directed by Project Manager. Mold three 2 inch square cubes. Test one cube for compressive strength at 7 days and test other 2 cubes for compressive strength at 28 days in accordance with ASTM C 109.

END OF SECTION

Section 03315

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.

2. Obtain services of and pay for certified testing laboratory to prepare design mixes.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

AB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

AC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

AD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

AE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

AF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

AG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

AH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AI. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

AJ. CRSI MSP-1 - Manual of Standard Practice.

AK. CRSI - Placing Reinforcing Bars.

AL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

AM. NRMCA - Concrete Plant Standards.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed mix design and test data for each type and strength of concrete in Work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Project Manager.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.05 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 P R O D U C T S

2.01 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Project Manager; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na_2O + $0.658K_20$.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.

2. Fine Aggregate: ASTM C 33.

3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:

1. Water Reducers: ASTM C 494, Type A.

2. Water Reducing Retarders: ASTM 494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:

1. Fibrillated Polypropylene Fiber:

a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.

b. Physical Properties:

1. Material: Polypropylene

2. Length: 1/2 inch or graded

3. Specific Gravity: 0.9l

c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.

2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.

a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.

b. Physical Properties

1. Material: Steel

2. Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1

3. Specific Gravity: 7.8

4. Tensile Strength: 40-400 ksi.

5. Young's Modulus: 29,000 ksi

6. Minimum Average Tensile Strength: 50,000 psi

7. Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.02 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S

lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.04 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Project Manager for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Project Manager.

D. Classification:

CLASS	TYPE	MINIMUM COMPRESSIVE STRENGTH		MAXIMUM W/C RATIO	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP (INCHES)
		7-DAY 3200	28-DAY			
B	Pipe Block Fill, Thrust	----	1500	----	4± 1	5 to 7
*When ASTM C 494, Type F or Type G admixture is used to increase workability, this range may be 6						

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:

1. Thickness: not less than 3/8 inch

2. Acceptable Manufacturers:
   a. Kirkhill Rubber Co., Brea, California

   b. Water Seals, Inc., Chicago, Illinois

   c. Progress Unlimited, Inc., New York, New York

   d. Greenstreak Plastic Products Co., St. Louis, Missouri

   e. Approved equal.

2.07 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.

B. Bentonite Waterstop:

1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.

2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.

3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch

4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:

1. Preformed plastic adhesive waterstop at least 2 inches in diameter.

2. Meets or exceeds requirements of Federal Specification SS-S-210A.

3. Supplied wrapped completely by 2 part protective paper.

4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.

5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.

6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko- Flex Products, Inc.; or approved equal.

PART 3 E X E C U T I O N

3.01 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Project Manager, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Project Manager and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Project Manager. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Project Manager before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Project Manager.

3.05 PLACING CONCRETE

A. Give sufficient advance notice to Project Manager (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Project Manager's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on

projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

C. Splicing PVC Waterstops:

1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer’s printed instructions.

2. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.

3. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24 inch long strips of waterstop material beyond joint. Upon inspection and approval by Project Manager, install prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24 inch strips to straight-run portions of waterstop in forms.

D. Setting PVC Waterstops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of work to ensure proper embedment in concrete and to prevent folding over of waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6 inches below top of wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Specifications.

F. Resilient Waterstop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.

2. When requested by Project Manager, provide technical assistance by manufacturer's representative in field at no additional cost to City.

3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6 inches and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.

5. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6 inches from top in vertical wall joints.

6. Bentonite Waterstop:

a. Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1 1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.

c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm material or its properties. Do not install waterstop where air temperature falls outside manufacturer's

recommended range.

d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

e. In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12 inch maximum spacing.

7. Adhesive Waterstop:

a. With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.

b. If surface is too rough to allow waterstop to form complete contact, grind to form adequately smooth surface.

c. Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1 inch and cover back over with protective paper.

d. Do not remove protective paper until just before final form work completion. Place concrete immediately. Time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.07 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Project Manager. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Project Manager.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.

2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Project Manager. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.

2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing

operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Project Manager.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow resetting. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Unless otherwise directed by Project Manager, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.

2. Make one set of four compression test specimens for each mix design at

least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.

3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.

4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Project Manager, at no additional cost to City.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by City.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Project Manager.

END OF SECTION
Section 04061

MORTAR

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Mortar and grout for masonry.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for mortar under this Section. Include payment in Lump Sum for building or structure with price breakdown included in Schedule of Values.

2. Refer to Section 01270 - Measurement and Payment and Section 01292- Schedule of Values.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 143 - Standard Testing Method for Slump of Hydraulic Cement Concrete

B. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

C. ASTM C 150 - Standard Specification for Portland cement.

D. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.

E. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

F. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout.

G. ASTM C 476 - Standard Specification for Grout for Masonry.

H. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

I. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Include design mix, indicate Property Method used, required environmental conditions, and admixture limitations.

C. Samples: Submit two ribbons of each mortar color, illustrating color and color range.

D. Submit test reports under provisions of Section 01450 - Contractor's Quality Control.

E. Submit test reports on mortar indicating conformance to ASTM C 270.

F. Submit test reports on grout indicating conformance to ASTM C 476.

G. Submit manufacturer's certificate under provisions of Section 01450 - Contractor's Quality Control, that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site and store and protect products under provisions of Section 01610 - Basic Product Requirements.

B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperatures to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

1.07 MIX TESTS

A. Test mortar and grout in accordance with Section 01454 - Testing Laboratory Services.

B. Testing of Mortar Mix: Test in accordance with ASTM C 780. Test mortar mix for compressive strength, consistency, mortar aggregate ratio, water content, air content, and splitting tensile strength.

C. Testing of Grout Mix: Test in accordance with ASTM C 109. Test grout mix for compressive strength and slump.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Portland Cement: ASTM C 150, Type I, white color.

B. Masonry Cement: Not permitted.

C. Mortar Aggregate: ASTM C 144, standard masonry type. Grading and color suitable for type of masonry, one source for entire project. (Not less than 5 percent shall pass No. 100 sieve).

D. Hydrated Lime: ASTM C 207, Type S.

E. Grout Aggregate: ASTM C 404.

F. Water: Clean and potable.

2.02 MORTAR COLOR

A. Mortar Color: Mineral oxide pigment; color; to be selected by Project Manager from manufacturer's samples.

2.03 ADMIXTURES

A. Antifreeze: Antifreeze admixtures will not be permitted.

B. Accelerator: Accelerator may be used only with approval of Project Manager.

2.04 MORTAR

A. Mortar for Load Bearing Walls and Partitions: ASTM C 270, Type S utilizing Property Method to achieve 1800 psi strength.

B. Mortar for Non-load Bearing Walls and Partitions: ASTM C 270, Type S utilizing the Property Method to achieve 1800 psi strength.

C. Mortar for Masonry below Grade or in Contact with Earth: ASTM C 270, Type M utilizing the Property Method to achieve 2500 psi strength.

D. Pointing Mortar: ASTM C 270, Type N, using the Property Method to achieve 750 psi strength.

2.05 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 270 to achieve strengths noted in Paragraph 2.04.

B. Add mortar color and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

C. Do not use anti-freeze compounds to lower freezing point of mortar.

D. If water is lost by evaporation, retemper only within 2 hours of mixing.

E. Use mortar within 2 hours after mixing at temperatures of 80 degrees F, or 2 1/2 hours at temperatures under 50 degrees F.

2.06 GROUT

A. Bond Beams, Lintels, and Other Areas to be Grouted Solid: 3000 psi strength at 28 days; 7 to 8 inches slump per ASTM C 143; mixed in accordance with ASTM C 476, Fine Grout.

2.07 GROUT MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 476, Fine Grout.

B. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.

C. Do not use anti-freeze compounds to lower freezing point of grout.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Request inspection of spaces to be grouted.

3.02 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean out holes with masonry units to prevent leakage of grout materials. Brace masonry for wet grout pressure.

3.03 INSTALLATION

A. Install mortar and grout in accordance with manufacturer's instructions.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not displace reinforcement while placing grout.

D. Remove grout spaces of excess mortar.

END OF SECTION

Section 04210

BRICK MASONRY FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Brick masonry work in utility construction for permanent or temporary installation of below ground structures.

B. Brick masonry in repair and rehabilitation of utility lines and associated structures.

1.02 UNIT PRICES

A. No payment will be made for brick masonry under this Section unless specifically noted in bid documents. Include payment in unit price for applicable utility structure section.

1.03 REFERENCES

A. ASTM C 32 - Specification for Sewer and Manhole Brick (Made from Clay or Shale).

B. ASTM C 55 - Standard Specification for Concrete Building Brick.

C. ASTM C 62 - Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).

D. ASTM C 67 - Methods of Sampling and Testing Brick and Structural Clay

Tile.

E. ASTM C 91 - Specification for Masonry Cement.

F. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).

G. ASTM C 140 - Standard Method of Sampling and Testing Concrete Masonry Units.

H. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification from the manufacturer that brick units meet applicable requirements of reference standards.

C. As an alternate to providing certification, submit test results that show brick units meet applicable requirements of reference standards, when tested by an approved independent testing laboratory. Test result submittals shall be at no cost to the City.

1.05 HANDLING AND STORAGE

A. Handle and store brick to prevent damage.

B. Store brick and mortar mix off the ground and in a dry place. Cover mortar mix to protect from weather.

PART 2 P R O D U C T S

2.01 CLAY AND SHALE BRICK MASONRY UNITS

A. Manholes and Structures: Use brick units made from clay or shale conforming to requirements of ASTM C 32, Grade MM, either cored or solid. Units shall have the following physical properties:

1. Compressive Strength: 2200 psi minimum for individual brick; 2500 psi average for five bricks.

2. Size: 2-1/4" by 7-5/8" by 3-5/8".

3. Test Procedure: ASTM C 67.

B. Sewer Brick: Use brick units made from clay or shale conforming to requirements of ASTM C 32, Grade SM, either cored or solid. Units shall have the following physical properties:

1. Compressive Strength: 3750 psi minimum for individual brick; 5000 psi average for 5 bricks.

2. Size: 2-1/4" by 7-5/8" by 3-5/8".

3. Test Procedure: ASTM C 67.

2.02 CONCRETE BRICK MASONRY UNITS

A. Manholes and Structures: Conform to requirements of ASTM C 55, grade S-1.

B. Dimensions: 2-1/4" by 7-5/8" by 3-5/8".

2.03 MORTAR

A. Provided mortar conforming to the requirements of Section 4061 - Mortar.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Ensure that foundations and other surfaces to support brickwork are at proper grades and elevations. Correct improperly prepared surfaces. Work surfaces and masonry shall be free of dirt, grease, oil, or other harmful materials before starting brick masonry work.

3.02 WEATHER REQUIREMENTS

A. Lay no masonry when temperature of outside air is below 50 F, unless satisfactory means are provided to heat materials and protect work from cold and frost.

B. Maintain mortar at 50 F or above and ensure that mortar will harden without freezing.

3.03 BRICK PLACEMENT

A. Use sewer brick where exposed to flow. Where not exposed to flow, use manhole brick.

B. Lay sewer brick with the 2-1/4" by 7-5/8" side exposed to flow.

C. Lay manhole bricks so that in every fifth course the long axis of bricks are perpendicular to the long axis of the four preceding courses.

D. Lay curved courses, and courses in different planes, using bonded and keyed construction.

E. Lay brick plumb and true with courses level and uniformly spaced. Adjust the bond of face brick so that no course will terminate with a piece less than one-half length of brick.

F. Dampen brick prior to placement.

G. Where fresh masonry joins partially set or totally set masonry, clean surfaces of set masonry. Remove loose mortar and brick. Wet brick to obtain the best possible bond.

H. Immediately remove mortar droppings and splashing as work progresses to facilitate final cleaning.

3.04 JOINTS

A. Completely fill joints in brick and other materials with mortar as each course is laid.

B. Make joints in exposed brickwork a uniform 3/8-inch wide, unless otherwise shown on Drawings.

C. When mortar is "thumbprint" hard, tool exposed joints with a round or other suitable jointer that is slightly larger than width of the mortar joint. In tooling, make sure that cracks and crevices are closed.

D. Point holes in exposed masonry. Cut out defective joints and repoint.

3.05 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. A minimum of one set of mortar samples shall be molded for each day's placement as directed by Project Manager. Mold three 2-inch cube specimens. One cube will be tested for compressive strength at 7 days and 2 cubes will be tested for compressive strength at 28 days in accordance with ASTM C 109.

C. Each load of bricks delivered to the jobsite shall be tested.

1. Test clay bricks in accordance with ASTM C 167.

2. Test concrete bricks in accordance with ASTM C 140.

END OF SECTION

Section 09000

PAINT FOR BRIDGE COLUMNS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Material

B. Application

1.02 UNIT PRICES

A. Measurement for paint is a lump sum basis.

B. Refer to Section Measurement and Payment for unit price procedures.

PART 2 PRODUCTS – (see General 3.01)

PART 3 EXECUTION

3.01 GENERAL

A. Two component (mixing ratio - 3:1) aliphatic acrylic polyurethane coating system that is highly resistant to graffiti, abrasion, wet conditions, corrosive fumes and chemical contact. When fully cured, it exhibits outstanding retention of initial gloss on long-term weather exposure. It is also highly resistant to the chemicals used in graffiti removal that allows graffiti to be removed without damaging the finish. Recommended for coating steel tank exteriors, equipment and structures, galvanized steel, non-ferrous metals, concrete, wood and masonry in highly corrosive or graffiti prone environments. Curing Time: @ 70 F. and 50% Relative Humidity: Dries to touch - 2 1/4 hours; to handle - 10 hours; to recoat - 16 to 20 hours; full graffiti resistance - 7 days. Application Methods: Brush, roller or spray

3.02 PREPARATION – (see General)
3.03 EQUIPMENT

A. It is recommended that we specify that the paint must be applied with a roller

and brush in lieu of spraying to avoid any damage to nearby vehicles.

END OF SECTION

PERFORMANCE TIME

1.1 The Contractor shall have **120 calendar days** to complete all work associated with and required by the contract.

STRUCTURAL DRAWINGS

1.2 Structural Drawings all Parking Lot Improvements begin on the following pages

STRUCTURAL DRAWINGS FOR PIERCE ELEVATED
PARKING LOT IMPROVEMENTS
can be viewed on the following website
https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23579

CITY OF HOUSTON

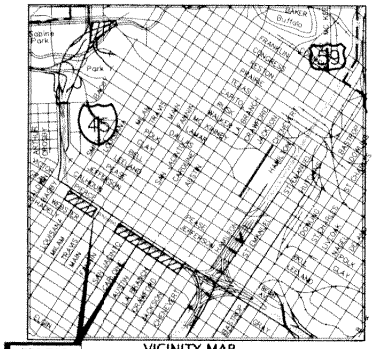
GENERAL SERVICES DEPARTMENT

HOUSTON-PIERCE ELEVATED PARKING LOT IMPROVEMENTS

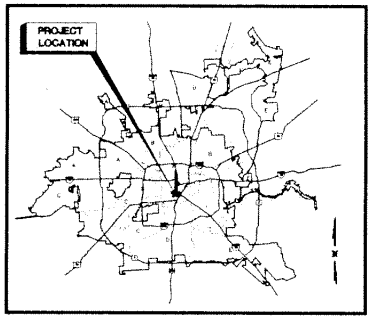
LOUISIANA TO JACKSON STREET

WBS No. D-00127-0002-4

January, 2010



VICINITY MAP



LOCATION MAP

MAYOR
ANNISE D. PARKER

CONTROLLER
RONALD C. GREEN

DISTRICT COUNCIL MEMBERS

BRENDA STARDIG DISTRICT A	JARVIS JOHNSON DISTRICT B	ANNE CLUTTERBUCK DISTRICT C
WANDA ADAMS DISTRICT D	MIKE SULLIVAN DISTRICT E	AL HOANG DISTRICT F
OLIVER PENNINGTON DISTRICT G	EDWARD GONZALEZ DISTRICT H	JAMES G. RODRIGUEZ DISTRICT I

AT-LARGE COUNCIL MEMBERS

STEPHEN C. COSTELLO POSITION 1	SUE LOVELL POSITION 2
MELISSA NORIEGA POSITION 3	C.O. "BRAD" BRADFORD POSITION 4

JOLANDA "JO" JONES
POSITION 5

CONTRACTING AUTHORITY
FOR THE
CITY OF HOUSTON:

GENERAL SERVICES DEPARTMENT
ISSA Z. DADOUSH, P.E.

CITY DWG. No: _____

INDEX OF SHEETS

1. COVER
2. GENERAL NOTES
3. PIERCE OVERALL LAYOUT
4. ~~LOT "A" OVERALL LAYOUT~~ (NOT IN THE CONTRACT)
5. STRIPING LAYOUT - LOUISIANA TO MILAM STREET
6. STRIPING LAYOUT - MILAM TO TRAVIS STREET
7. STRIPING LAYOUT -TRAVIS TO MAIN STREET
8. STRIPING LAYOUT - FANNIN TO SAN JACINTO STREET
9. STRIPING LAYOUT - SAN JACINTO TO CAROLINE STREET
10. STRIPING LAYOUT - CAROLINE TO AUSTIN STREET
11. PLAN AND PROFILE - CAROLINE TO AUSTIN STREET
12. STRIPING LAYOUT - AUSTIN TO LA BRANCH STREET
13. PLAN AND PROFILE - AUSTIN TO LA BRANCH STREET
14. STRIPING LAYOUT - LA BRANCH TO CRAWFORD STREET
15. PLAN AND PROFILE - LA BRANCH TO CRAWFORD STREET
16. STRIPING LAYOUT - CRAWFORD TO JACKSON STREET
17. DRAINAGE AREA MAP / STORM CALCULATIONS
18. SWPP PLAN - LOUISIANA TO JACKSON

DETAILS

19. SWPPP DETAILS
20. TRAFFIC CONTROL PLAN / DETAILS
21. GENERAL DETAILS 1 OF 2
22. GENERAL DETAILS 2 OF 2
23. ~~FENCE AND SIGNAGE DETAILS~~ (NOT IN THE CONTRACT)

ELECTRICAL

24. E-1.00
25. E-1.10
26. E-1.20
27. E-1.30
28. E-1.40
29. E-1.50

ILMS #08015200 LOG NO. 08-0199

HR | CLAUNCH & MILLER Engineering Consultants

SURVEYED BY: Landtech Consultants, Inc.
FB NO.: 566-295, 566-297 and 566-298

24 Jan. 2010

MAYOR	CONSTRUCTOR
WASTEWATER	TRAFFIC AND TRANSPORTATION
STORMWATER	SPONSOR DEPARTMENT
STREET & BRIDGE	CHIEF ENGINEER
CITY ENGINEER DATE	
DIRECTOR OF PUBLIC WORKS AND ENGINEERING DATE	

SHEET NO. 1 OF 29 SHEETS

CAD FILE 1

GENERAL CONSTRUCTION

1. Construct wastewater collection systems, water lines, storm drainage and street paving in accordance with the latest edition of the publication Standard Construction Specifications For Wastewater Collection Systems, Water Lines, Storm Drainage, and Street Paving and Standard Construction Details For Wastewater Collections Systems Water Lines, Storm Drainage, and Street Paving published by the City of Houston, Department of Public Works and Engineering.
2. Utilities presented on these drawing are shown based on the best available information. Contractor shall verify the exact locations in the field prior to commencing construction. Contractor shall notify Texas One Call at 713-223-4567/800-245-4545 and Lone Star One Call at 800-669-8344 at least 48 hours before proceeding with any excavations.
3. Contractor shall be responsible for damages to existing water, wastewater, storm water lines and traffic control devices. Damages shall be repaired in accordance with the City of Houston, Department of Public Works and Engineering's Standard Construction Specification For Wastewater Collection Systems, Water Lines, Storm Drainage, and Street Paving and Standard Construction Details For Wastewater Collection Systems, Water Lines, Storm Drainage, and Street Paving, referenced above, at no additional cost.
4. Contractor shall notify the Office of the City Engineer, Department of Public Works and Engineering at 713-863-1450 for inspection at least 48 hours prior to commencing construction.
5. Adequate drainage shall be maintained at all times during construction and any drainage ditch or structure disturbed during construction shall be restored to existing conditions or better.
6. Contractor shall comply with latest edition of OSHA regulations and the State If Texas laws concerning excavations, trenching and shoring.
7. This project shall be built by means of Auguring except as noted on the drawings. Contractor to determine the locations of bore pits in field subject to the City Engineer's approval.
8. The sizes of water meters shown but not specifically called out in this project are one inch or smaller standard City of Houston water meters. All other sizes larger than one inch are specifically called out on these drawings.
9. Temporarily relocate existing utilities in conflict with proposed construction as required to provide continuous service by the utility. After construction return utility to original location.
10. Obtain Engineer's prior approval to permanently relocate existing utilities not shown on the drawings. Conform to applicable standards and specifications.
11. The location of underground utilities are shown in an approximate way. Pre-locate, by whatever means may be required, (metal detection equipment, probes, excavation, survey) underground utilities before trenching. Perform repairs required after investigation. No separate pay item. Contractor agrees to be fully responsible for any and all damages which might be caused by his failure to exactly locate and preserve these underground utilities.
12. Test materials to be used for backfill and adjust moisture content to specified levels by adding water or drying soils as necessary and as specified.
13. Perform daily clean-up in affected construction areas in order to restore site to existing or better conditions. Areas should be free of debris, scrap material, dirt, mud and other items identified by City Engineer. Do not leave streets or other construction areas unclean overnight.

SURVEY AND BENCH MARK REFERENCE

1. Dimensions shown are approximate and are to be verified. Horizontal and vertical alignment changes are to be approved by City Engineer.
2. Coordinates shown are referenced to Texas Coordinate System, South Central Zone. Distances shown are surface distances.
3. Vertical control is set primarily by PK nails in existing pavement. Maintain vertical control throughout duration of project by whatever means necessary.

TREE AND LANDSCAPE PROTECTION

1. In areas where existing landscaping requires removal due to proposed improvements, contact Engineer and obtain desired location to relocate within R.O.W. Relocate in accordance with specifications. Take necessary precautions to protect root systems of shrubs, plants and trees along the area of excavation.

SANITARY NOTES

1. Sanitary sewer gravity lines shall be constructed in accordance with the appropriate specification item.
2. PVC fittings shall be constructed in accordance with the appropriate specification item. PVC fittings shall meet the requirements of ASTM D-3034 Service connection pipe and fittings shall be PVC Sch. 40.
3. Contractor shall maintain the integrity of the existing sewer system during construction.
4. The Contractor shall be aware that there may be service connections in existence which do not appear on these drawings. It is the Contractor's responsibility to locate all existing services and laterals and reconnect them per details & specifications. All 8"-15" diameter Sanitary sewer lines shall be constructed as per COH specifications.

STORM SEWER AND CULVERTS

1. Where plans call for existing storm sewers to be removed, Engineer may direct Contractor to abandon existing storm sewer in place in order to protect trees, landscaping or other items.

WATER NOTES

1. Wet connections are to be coordinated with the City in such a manner and at such hours as to cause the least inconvenience to the public.
2. All water line fittings shall have mechanical joints (except where noted).
3. Contractor shall maintain the integrity of the existing water lines during construction, including service lines. Following construction, testing, and disinfection of new water lines.
4. Contractor may deflect water lines slightly to avoid conflicts with utilities or other obstruction. Contractor to verify depth of existing water line prior to installing proposed fire hydrant assembly. Contractor to keep accurate records of locations where water lines are deflected for required red line record print set. Such deflection shall be within the limits allowed and recommended by the Manufacturer of the pipe.
5. Contractor is to install temporary blow-off valves as required to flush the newly constructed water line for chlorination and testing. Blow-off valve shall be removed by the Contractor upon successful completion of all testing. (No separate pay).
6. Contractor to allow 12-inch minimum clearance between proposed water lines and other facilities unless otherwise noted. For clearance of sanitary sewer facilities use or Texas Commission on Environmental Quality (TCEQ) criteria.
7. Water service lines exist within the street right of way throughout the contract limits. Contractor shall avoid disruption of water service. Where existing water service lines are damaged by the Contractor, Contractor shall replace the service line at no extra cost to the owner.

MISCELLANEOUS

1. Adjustment of existing and proposed manhole frames and covers, valve boxes, etc. is incidental to cost of installation and removal of temporary or permanent pavement.
2. Adjust manhole rings, valve boxes, grates, etc. as required for new pavement, and/or to finished grade outside pavement. No separate pay.
3. Perform critical location procedures at gas line, telephone, and communications cable or conduit locations shown on Drawings, whether or not they are labeled as "Critical locations".

STREET, BRIDGE AND R.O.W.

1. Condition of road and/or right of way, upon completion of job, shall be as good or better than prior to starting work.
2. Expose 15" of reinforcing steel at proposed sawed joint. If no reinforcing steel exists, use horizontal dowels that are #6 bars, 24" long, 24" C-C drilled and embedded 8" into center of existing slab with "Po Roc" or equal. (No additional cost)
3. Replace existing pavements, curbs, sidewalks and driveways damaged or removed during construction to City of Houston standards, latest addenda and amendments thereto.
4. Take necessary precautions to protect root systems of shrubs, plants and trees along the area of excavation.

LIMITS OF CONSTRUCTION

1. Limit operations to within confines of City Right of Way and easements or construction work limits shown on drawings. Unless otherwise noted following more specific terms apply and are to be adhered to:
   A. When tunneling or augering is shown on plans, access (open cut) from surface is denied. Exceptions to these restrictions are for emergency situations where action is required to safe guard the work in progress or other existing utilities. In this case, the Engineer is to be immediately notified of additional traffic control procedures that will be implemented and any other necessary actions that will be taken until situation has been rectified.

TRAFFIC NOTES

1. Contractor shall provide and install Traffic control Devices in Conformance with PART VI of the Texas Manual on Uniform Traffic control Devices (Texas Match, most Recent Edition with Revisions) during construction.
2. Contractor shall obtain Lane Closure Permits when lane Closure are required Requests must be made at least Three Days prior to the date of which Closure is Sought. Call 713-637-7280 for an Application.
3. Contractor shall Cover Excavations with Adequately Anchored Steel Plates During Non-Working hours and open land for Traffic Flow.
4. If Contractor choose to use a different Method of "Traffic Control Plans" During Construction than what is outlined in the Traffic Control Plan or if (s)he Desires to block a lane for which no Traffic Control Plan was Submitted, (s)he shall be Responsible to submit an Alternate set of Traffic Control Plans on Reproducible Mylars sealed and signed by a Professional Engineer Licensed by the State of Texas, with the Approved set of Drawing to Plans Review Section for Approval 10 working Days prior to Implementation.
5. Approved Copies of "Traffic control Plans" and lane Closure Permits shall be Available for Inspection at Job Site at all Times.

ONE-CALL NOTIFICATION SYSTEM
CALL BEFORE YOU DIG!!!
(713) 223-4567 (in Houston)
(New Statewide Number Outside Houston)
1-800-545-6005

Contractor shall notify the City of Houston, Department of Public Works and Engineering. Engineering Constructuion Division (Telephone No. 713-863-1450) 48 hours before starting work on this Project.

THIS PROJECT INCLUDES WORK TO BE PREFORMED IN THE CITY OF HOUSTON'S RIGHT-OF-WAY AND MUST BE PERMITTED PRIOR TO CONSTRUCTION
CONTACT THE REQUIRED SECTIONS BELOW AS INDICATED

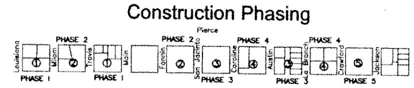
LOCATION - 3300 MAIN	
PAVING	713-535-7579
SANITARY	713-535-7885
WATER	713-535-7885
STORM	713-535-7579

LOCATION - 611 WALKER	
STREET CUT	713-837-0546

Construction Sequence shall be coordinated and approved with COH and Consulting Engineer. No two adjacent Parking sites shall be in construction simultaneously. Construction sites shall be addressed alternately allowing continuous access to Parking and traffic flow.

Example:

Construction Phasing



SBC FACILITIES

- The locations of SBC facilities are shown in an approximate way only. The Contractor shall determine the exact location before commencing work. He agrees to be fully responsible for any and all damages which might be occasioned by this failure to exactly locate and preserve these underground utilities.
- The Contractor shall call 1-800-344-8377 a minimum of 48 hours prior to construction to have underground lines field located.
- When excavating within eighteen inches (18") of the indicated location of SBC facilities, all excavations must be accomplished using non-mechanized excavation procedures. When boring the Contractor shall expose the SBC facilities.
- When SBC facilities are exposed, the Contractor will provide support to prevent damage to the conduit ducts or cables. When excavating near telephone poles the Contractor shall brace the pole for support.

CenterPoint Energy Gas

CAUTION: UNDERGROUND GAS FACILITIES

- Locations of CenterPoint Energy main lines (to include Unit Gas Transmission and/or Industrial Gas Supply Corporation where applicable) are shown in an approximate location only. Service lines are usually not shown. Our signature on these plans only indicated that our facilities are shown in approximate location. It does not imply that a conflict analysis has been made. The Contractor shall contact the Utility Coordinating Committee at (713) 223-4567 or 1-800-669-8344 a minimum of 48 hours prior to construction to have main and service lines field located.
- When CenterPoint Energy pipe line markings are not visible, call (713) 967-8037 (7:00 a.m. to 4:30 p.m.) for status of line location request before excavation begins.
- When excavating within eighteen inches (18") of the indicated location of CenterPoint Energy facilities, all excavation must be accomplished using non-mechanized excavation procedures.
- When CenterPoint Energy facilities are exposed, sufficient support must be provided to the facilities to prevent excessive stress on the piping.

The Contractor is fully responsible for any damages caused by his failure to exactly locate and preserve these underground facilities.

CenterPoint Energy Power

WARNING: OVERHEAD ELECTRICAL FACILITIES

Overhead lines may exist on the property. We have not attempted to mark those lines since they are clearly visible, but the Contractor should locate them prior to beginning any construction. Texas law, section 752, Health & Safety Code, forbids all activities in which persons or things MAY come within six (6) feet of live overhead high voltage lines. Parties responsible for the work, including Contractors, are legally responsible for safety of construction workers under this law. This law carries both criminal and civil liability. To arrange for lines to be turned off or removed, call CENTERPOINT ENERGY at 713-207-7777.

TIME WARNER CABLE

NOTE:
The location of Time Warner Cable utilities are shown in an approximate way only. Notify Texas One Call @ 713-223-4567 or 1-800-669-8344, 48 hrs. prior to starting construction to locate lines. The contractor shall determine the exact location before commencing work. He agrees to be fully responsible for any and all damages which might be occasioned by his failure to exactly locate and preserve these underground utilities.

Metro

Before Starting Construction Mr. Paul Weaver Of Metro Shall Be Contacted At 713-615-7223 (Office) Or 281-352-1500 (Cell).

Phonoscope

Before Starting Construction Mr. John Puente Of Phonoscope Shall Be Contacted At 832-615-7723 (Office) Or 281-630-2760 (Cell).

MCI Network Services, Inc.

Before Starting Construction Mr. Clay Breaux Of MCI Communications Shall Be Contacted At 281-901-3309 (Office).

ISSUE LOG		
NO.	DATE	DESCRIPTION

CONSULTANT(S):
C&M
CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S):
STATE OF TEXAS
GUILLERMO I. BACCERO
LICENSED
PROFESSIONAL ENGINEER
19 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER
SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777.

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LONE STAR NOTIFICATION 713-223-4567.

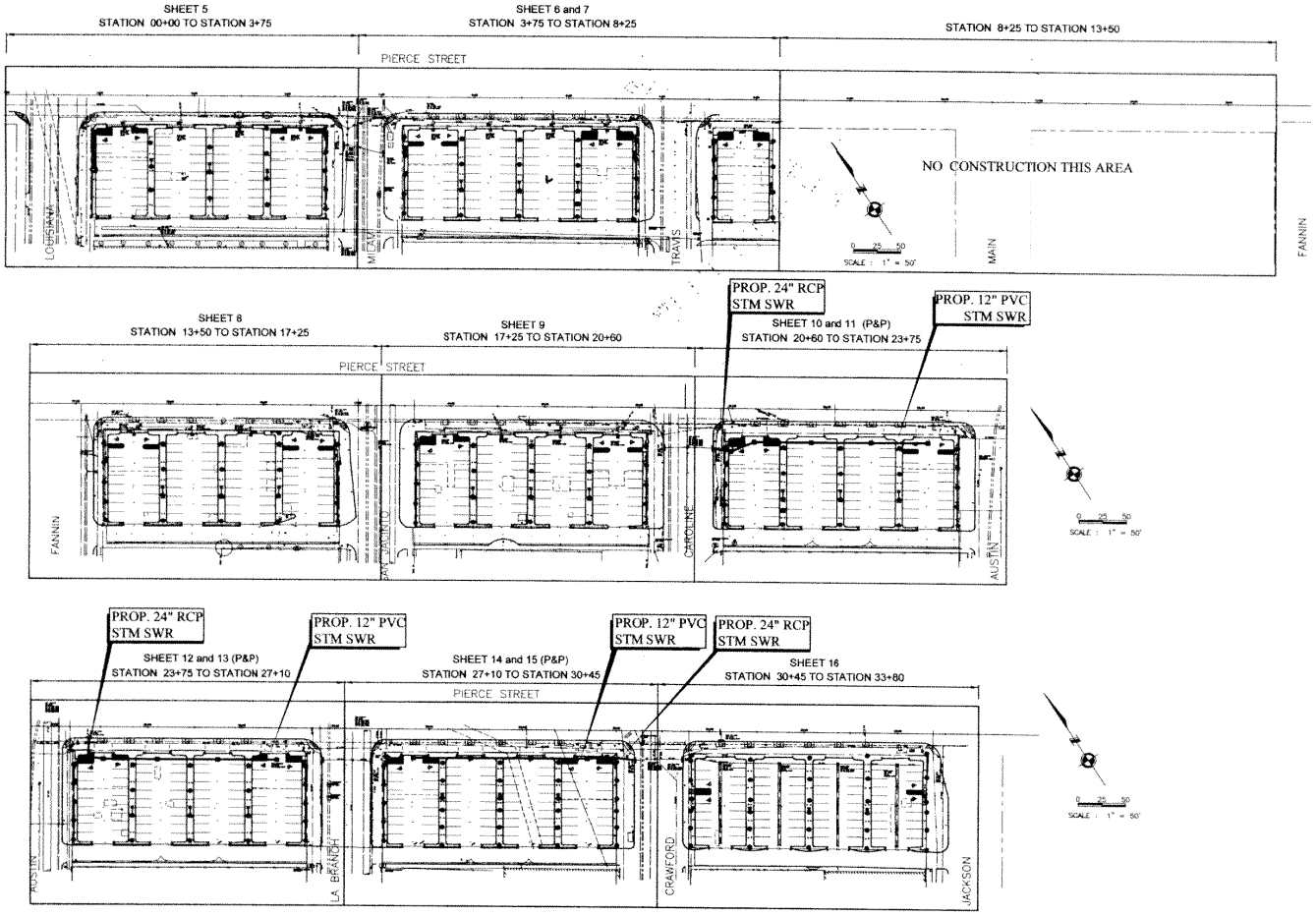
Date: 5-20-08
CenterPoint Energy/Electric Facilities
Approved only for crossing underground facilities, unless otherwise noted.) Valid at time of review only.
Date: 5-20-08
SBC Approved for underground conduit facilities only.
Date: 5-20-08
CenterPoint Energy/Gas Facilities
(Gas service lines are not shown.)

SHEET TITLE:
GENERAL NOTES

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:
FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ: NA
VERT:
SHEET No: 2 OF 29
CITY DWG. NO.:
REVISED JAN 2006



ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S) :

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-432-9294 • Fax: 713-622-9203 • www.claunchmiller.com

SEAL(S) :

STATE OF TEXAS
MILLER, MICHAEL L. 84645
LICENSED
PROFESSIONAL ENGINEER
9 May 01

PROJECT NAME :
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED :

PROJECT MANAGER — PLANNING DEPARTMENT

PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7700

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL ONE CALL SYSTEM NOTIFICATION 713-223-4567

Date
Centerpoint Energy/Electric Facilities
(Approved only for existing underground facilities, unless otherwise noted, made at time of review only)

Date
SBC Approved for underground conduit facilities only
(Approved only for one year)

Date
Centerpoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE :

PIERCE OVERALL LAYOUT
SHEET 1

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURE

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:

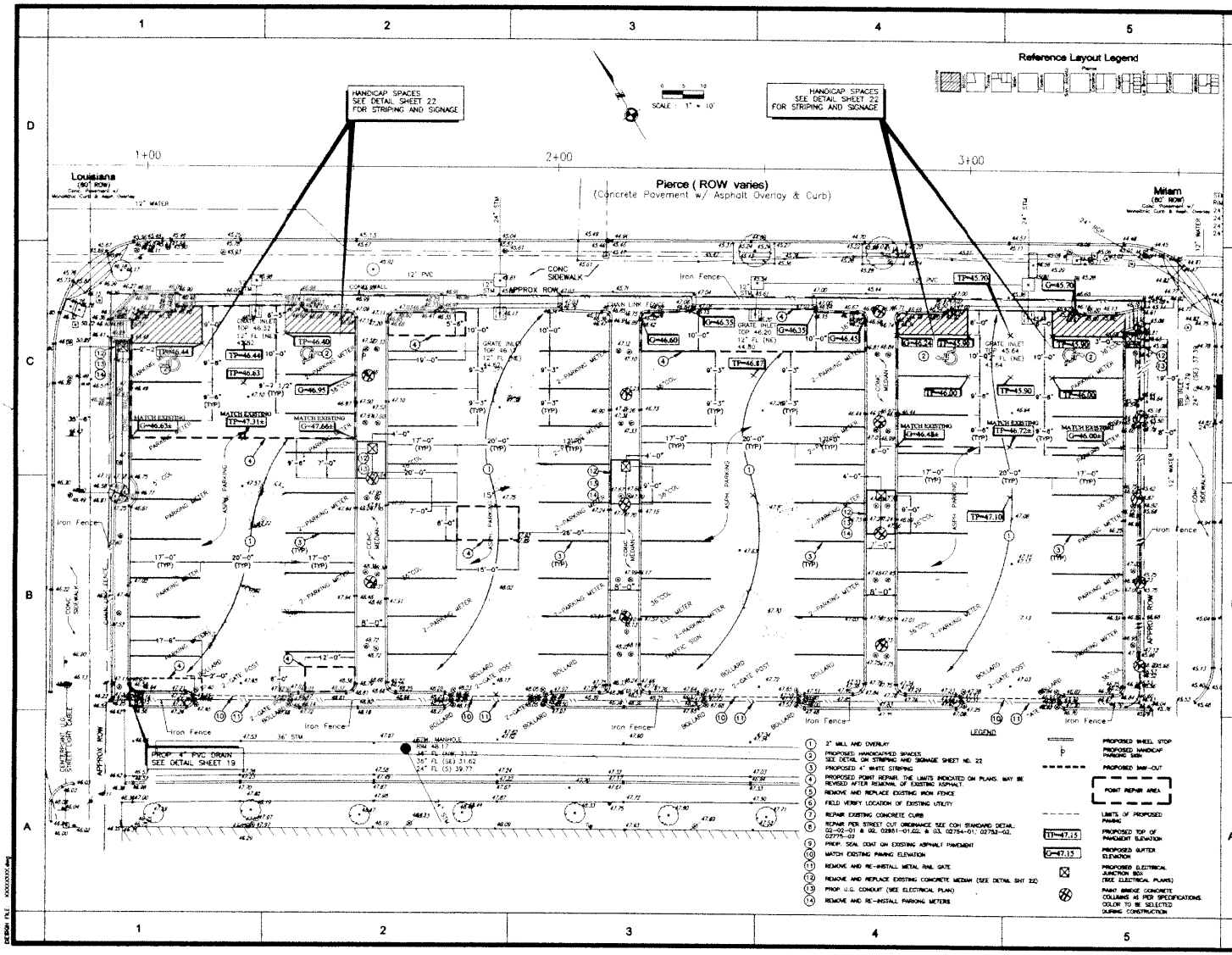
FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORZ : 1"=50'
VERT :

SHEET No: 3 OF 29

CITY DWG. NO. :

REVISED JAN 2000



ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4433 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchandmiller.com

SEAL(S):

STATE OF TEXAS
GUILLERMO MALDONADO
9 May 03

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PROJECT MANAGER

TO ARRANGE FOR LINES TO BE MARKED OUT OR MOVED, CALL CENTERPOINT AT 713-207-7777

PRIVATE UTILITY LINES SHOWN
(AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET, ALSO IN EASEMENTS. THE COMP. 8 LAW NUMBER IS 713-223-4567)

Date

Date

Date

SHEET TITLE:

STRIPING AND POINT REPAIR LAYOUT
STA 0+75 TO STA 3+61
LOUISIANA TO MILAM

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

DATE

DATE & SIGN

FILE NO:

FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE

HORZ : 1"=10'
VERT :

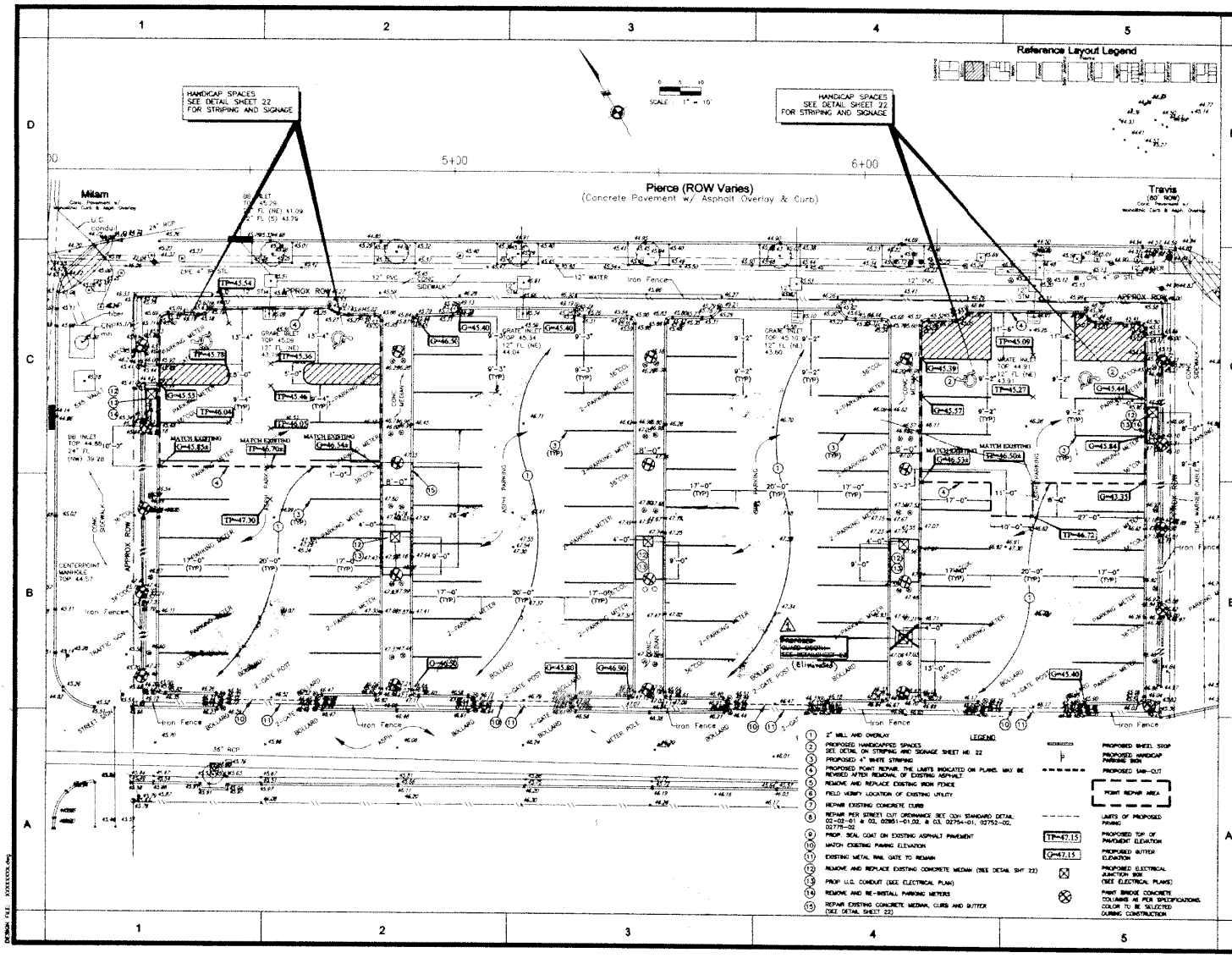
SHEET No. 5 OF 29

CITY DWGL NO.:

REVISED JAN 2006

DESIGN FILE

318 of 350



ISSUE LOG

NO.	DATE	DESCRIPTION
1	Jan. 22, 10	Deleted Guard Booth

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4653 Sandbrook Parkway, Suite 1000 • Houston, Texas 77027
713-622-9364 • Fax: 713-622-9267 • www.claunchmiller.com

SEAL(S): STATE OF TEXAS — BUILDING & SAFETY — 19 May 09

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PRIVATE UTILITY LINES SHOWN

SHEET TITLE:
STRIPING AND POINT REPAIR LAYOUT
STA 4+00 TO STA 6+85.50
MILAM TO TRAVIS

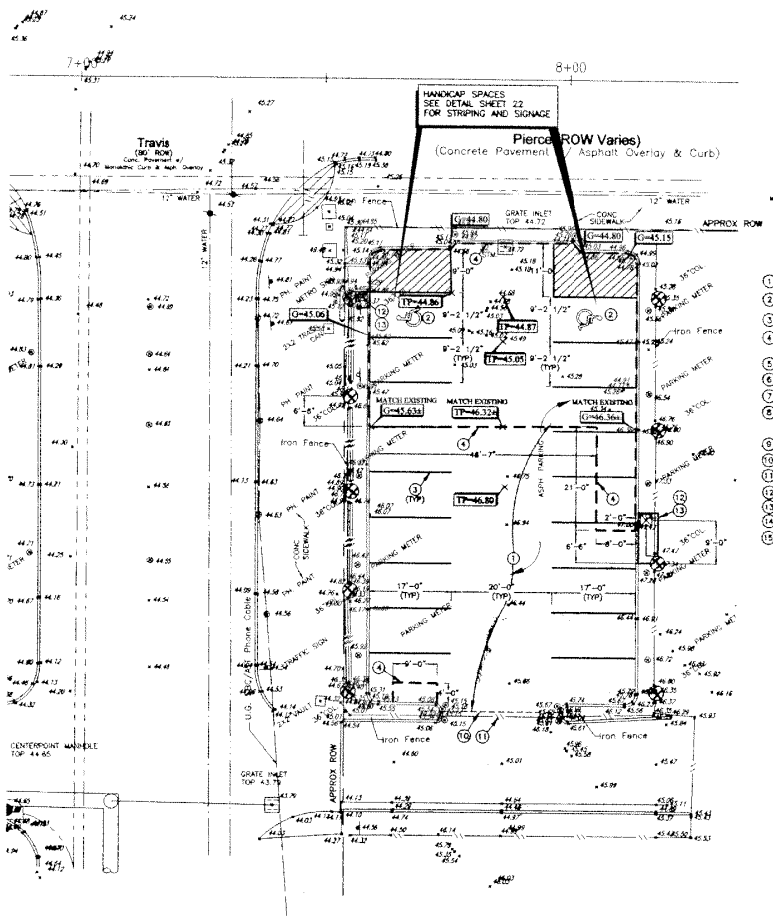
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO: | FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORZ: 1"=10'
VERT:

SHEET No: 6 of 29

CITY DWG. NO.: | REVISED JAN 2006



Reference Layout Legend

LEGEND

1. REMOVE EXISTING ASPHALT PAVEMENT AND REPLACE WITH 2-1/2" HMAC (MIN)
2. PROPOSED HANDICAPPED SPACES SEE DETAIL ON STRIPING AND SIGNAGE SHEET NO. 22
3. PROPOSED 4" WHITE STRIPING
4. PROPOSED POINT REPAIR. THE LIMITS INDICATED ON PLANS. MAY BE REVISED AFTER REMOVAL OF EXISTING ASPHALT.
5. REMOVE AND REPLACE EXISTING IRON FENCE
6. FIELD VERIFY LOCATION OF EXISTING UTILITY
7. REPAIR EXISTING CONCRETE CURB
8. REPAIR PER STREET CUT ORDINANCE SEE COH STANDARD DETAIL 02-02-01 & 02, 02951-01,02, & 03, 02754-01, 02752-02, 02775-02
9. PROP. SEAL COAT ON EXISTING ASPHALT PAVEMENT
10. MATCH EXISTING PAVING ELEVATION
11. REMOVE AND RE-INSTALL METAL RAIL GATE
12. REMOVE AND REPLACE EXISTING CONCRETE MEDIAN (SEE DETAIL SHT 22)
13. PROP. U.G. CONDUIT (SEE ELECTRICAL PLAN)
14. REMOVE AND RE-INSTALL PARKING METERS
15. REPAIR EXISTING CONCRETE MEDIAN, CURB AND GUTTER (SEE DETAIL SHEET 22)

POINT REPAIR AREA

PROPOSED WHEEL STOP

PROPOSED HANDICAP PARKING SIGN

PROPOSED SAW-CUT

LIMITS OF PROPOSED PAVING

TP=47.15 PROPOSED TOP OF PAVEMENT ELEVATION

G=47.15 PROPOSED GUTTER ELEVATION

PROPOSED ELECTRICAL JUNCTION BOX (SEE ELECTRICAL PLANS)

PAINT BRIDGE CONCRETE COLUMNS AS PER SPECIFICATIONS. COLOR TO BE SELECTED DURING CONSTRUCTION

ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4631 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-621-9384 • Fax: 713-623-9165 • www.claunchandmiller.com

SEAL(S): STATE OF TEXAS — GUILLERMO I. MILLER — LICENSED PROFESSIONAL ENGINEER — 19 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROJECT MANAGER — PROGRAM MANAGER
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE MARKED OFF OR MARKED, CALL CENTERPOINT AT 713-207-7777.
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LINE STAR NOTIFICATION 713-243-4567

Centerpoint Energy/Reliant Facilities (Gas, electric lines and duct structures) — Date
SBC (Southwestern Bell Telephone) underground conduit facilities only — Date
Comcast Cable (Cable TV) Facilities (Coax, optical fiber and duct structure) — Date

SHEET TITLE:
STRIPING AND POINT REPAIR LAYOUT
STA 6+85.5 TO STA 8+34
TRAVIS TO MAIN

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
PROJECT MANAGER — PROJECT ENGINEER & PROFESSIONAL
DATE — DATE
DATE & SEAL

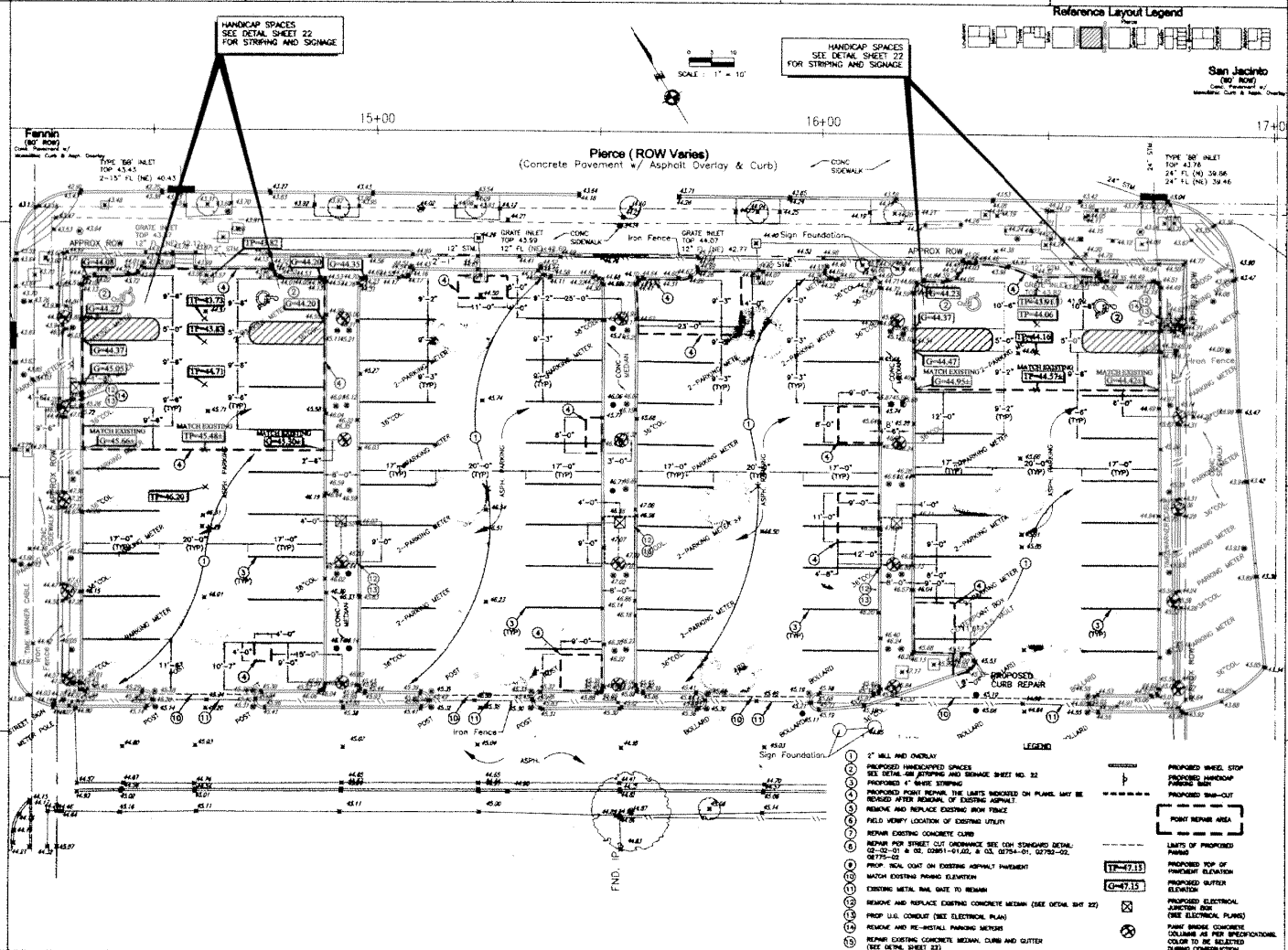
FILE NO: — FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORIZ: 1"=10'
VERT:

SHEET No. 7 OF 29

CITY DWG. NO.: — REVISED JAN 2006

DESIGN FILE: XXXXXXXX.dwg



ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1600 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchandmiller.com

SEAL(S):

STATE OF TEXAS
REGISTERED PROFESSIONAL ENGINEER
No. 65446
9 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROJECT MANAGER — PROJECTING ENGINEER
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE BURIED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777.
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE ENGAGING IN STREET B.D.N. OR EXCAVATION CALL "48 LONE STAR NORTH/CALL 713-223-4087

Date
Centerpoint Energy/Houston Pipelines
(See details, detail sheet and cut sheets)

Date
Approved for underground service facilities only
Not approved for aerial plant

Date
Centerpoint Energy/Gas Facilities
(See details, detail sheet and cut sheets)

SHEET TITLE:
STRIPING AND POINT REPAIR LAYOUT
STA 14+17.81 TO STA 17+02.81
FANNIN TO SAN JACINTO

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

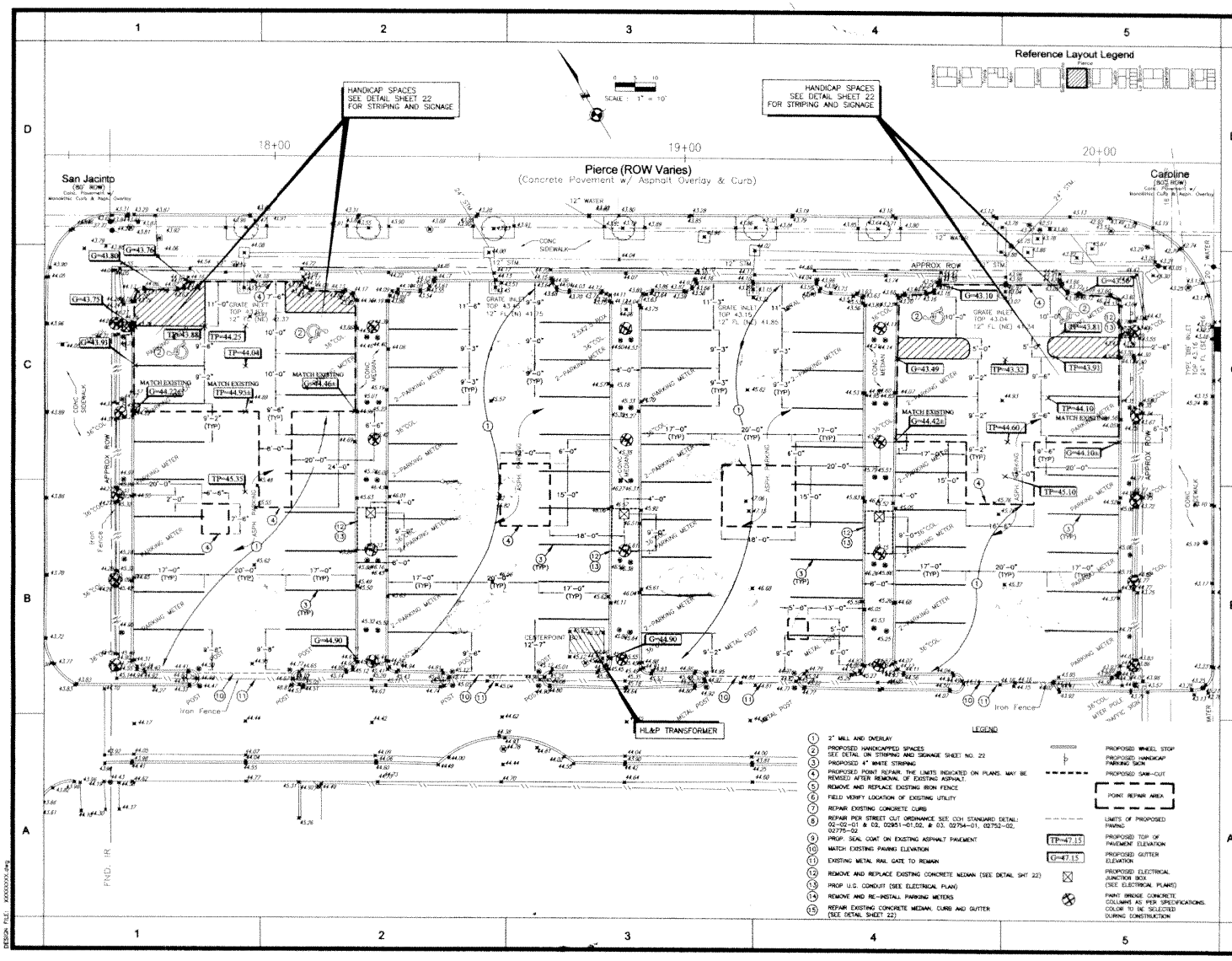
FILE NO: — FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORZ : 1"=10'
VERT :

SHEET No. 8 OF 29

CITY DWG. NO. : — REVISED JAN 2006

321 of 350



ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1900 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S):

STATE OF TEXAS — REGISTERED PROFESSIONAL ENGINEER — 19 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CONTRACTOR AT 713-241-1777.
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREETS OR EASEMENTS, CALL THE LONE STAR NOTIFICATION 713-223-4087.

Date
Centerpoint Energy/Reliant Facilities
(Approval only for crossing underground facilities, unless otherwise noted)
Note of fence only.

Date
SBC Approval for underground conduit facilities only.
Approval valid for one year.

Date
Centerpoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE:
STRIPING AND POINT REPAIR LAYOUT
STA 13+50 TO STA 20+29.16
SAN JACINTO TO CAROLINE

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

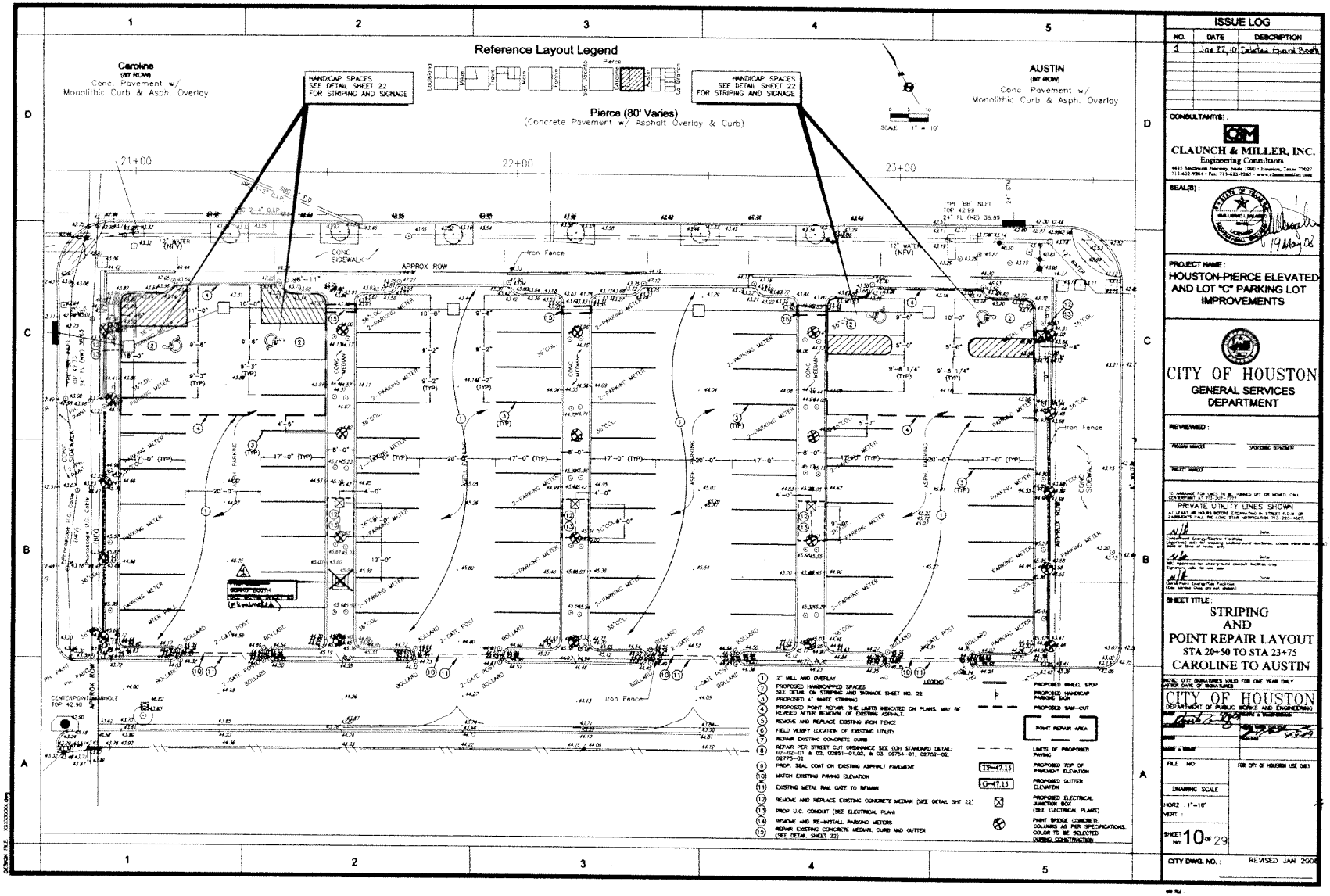
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
TRAFFIC & TRANSPORTATION
DATE
DATE
DATE
STREET & BRIDGE
DATE
FIELD NOTES

FILE NO:
FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORIZ : 1"=10'
VERT :
SHEET No: 9 OF 29

CITY DWG. NO.:
REVISED JAN 2006

DESIGN FILE: XXXXXXXX.dwg

322 of 350



ISSUE LOG		
NO.	DATE	DESCRIPTION
1	Aug 27, 10	Deleted Guard Booth

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants

SEAL(S):

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

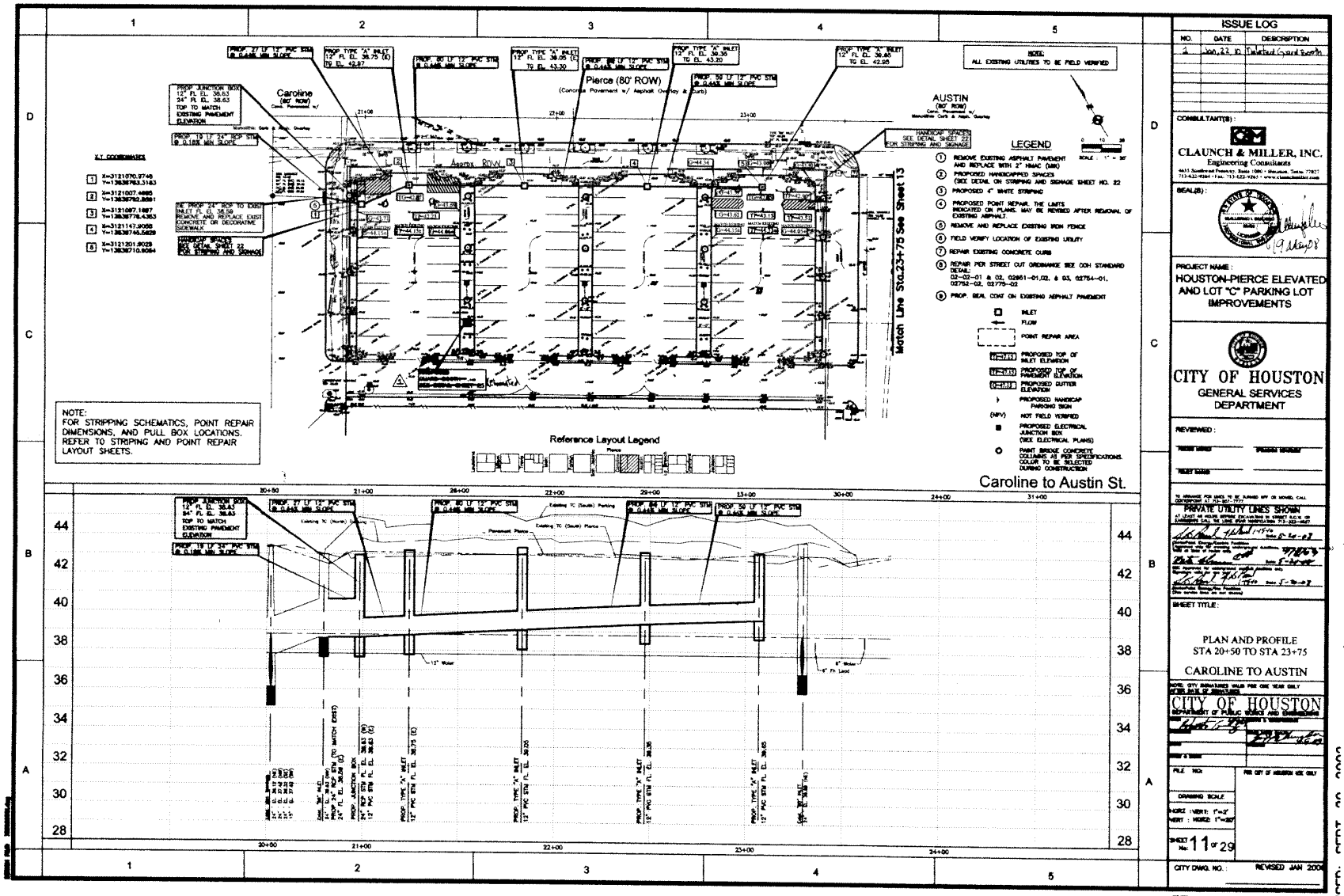
REVIEWED:

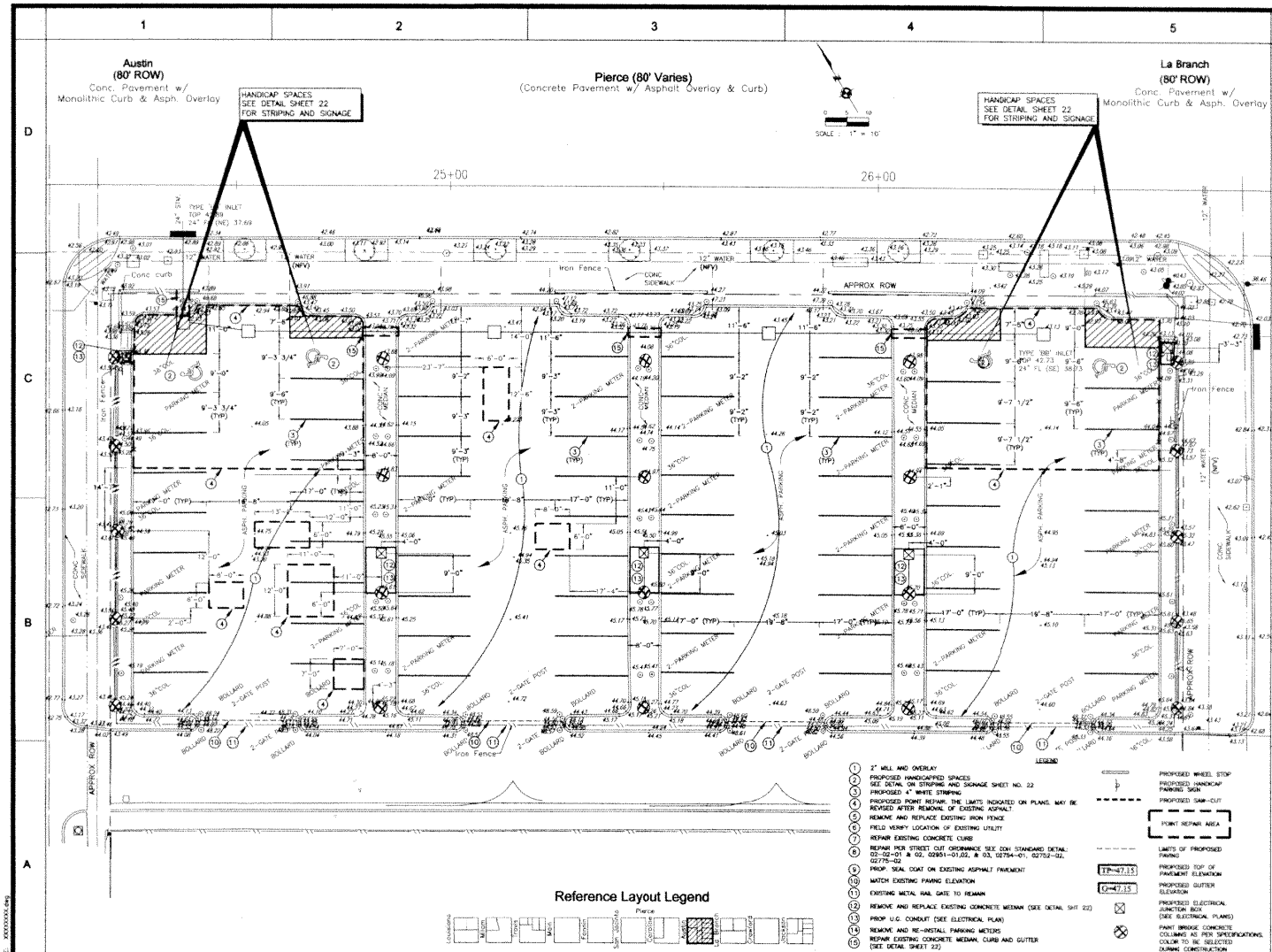
PRIVATE UTILITY LINES SHOWN

SHEET TITLE:
STRIPING AND POINT REPAIR LAYOUT
STA 20+50 TO STA 23+75
CAROLINE TO AUSTIN

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:
FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ : 1"=10'
VERT :
SHEET No. 10 OF 29
CITY DWG. NO.:
REVISED JAN 2006


Caroline (80' ROW)
Pierce (80' ROW)
(Concrete Pavement w/ Asphalt Overlay & Curb)
AUSTIN (80' ROW)
Match Line Sta.23+75 See Sheet 13
Reference Layout Legend
Caroline to Austin St.
NOTE: ALL EXISTING UTILITIES TO BE FIELD VERIFIED
LEGEND
1 REMOVE EXISTING ASPHALT PAVEMENT AND REPLACE WITH 2" HMAC (MIX)
2 PROPOSED HANDICAPPED SPACES (SEE DETAIL ON STRIPING AND SIGNAGE SHEET NO. 22
3 PROPOSED 4" WHITE STRIPING
4 PROPOSED POINT REPAIR. THE LIMITS INDICATED ON PLANS MAY BE REVISED AFTER REMOVAL OF EXISTING ASPHALT.
5 REMOVE AND REPLACE EXISTING IRON FENCE
6 FIELD VERIFY LOCATION OF EXISTING UTILITY
7 REPAIR EXISTING CONCRETE CURB
8 REPAIR PER STREET CUT ORDINANCE SEE COH STANDARD DETAIL: 02-02-01 & 02, 02951-01,02, & 03, 02754-01, 02752-02, 02775-02
9 PROP. SEAL COAT ON EXISTING ASPHALT PAVEMENT
INLET
FLOW
POINT REPAIR AREA
PROPOSED TOP OF INLET ELEVATION
PROPOSED TOP OF PAVEMENT ELEVATION
PROPOSED GUTTER ELEVATION
PROPOSED HANDICAP PARKING SIGN
(NFV) NOT FIELD VERIFIED
PROPOSED ELECTRICAL JUNCTION BOX (SEE ELECTRICAL PLANS)
PAINT BRIDGE CONCRETE COLUMNS AS PER SPECIFICATIONS. COLOR TO BE SELECTED DURING CONSTRUCTION
NOTE:
FOR STRIPPING SCHEMATICS, POINT REPAIR DIMENSIONS, AND PULL BOX LOCATIONS. REFER TO STRIPING AND POINT REPAIR LAYOUT SHEETS.
ISSUE LOG
NO. DATE DESCRIPTION
CONSULTANT(S):
CLAUNCH & MILLER, INC.
Engineering Consultants
SEAL(S):
PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS
CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT
REVIEWED:
PRIVATE UTILITY LINES SHOWN
SHEET TITLE:
PLAN AND PROFILE
STA 20+50 TO STA 23+75
CAROLINE TO AUSTIN
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
DRAWING SCALE
SHEET No. 11 OF 29
CITY DWG. NO.
REVISED JAN 2000



Reference Layout Legend

Pierce

Louisiana | Milam | Travis | Main | Fannin | San Jacinto | Crawford | Austin | La Branch | Cleveland | Dallas

LEGEND

1. 2" MILL AND OVERLAY
2. PROPOSED HANDICAPPED SPACES SEE DETAIL ON STRIPING AND SIGNAGE SHEET NO. 22
3. PROPOSED 4" WHITE STRIPING
4. PROPOSED POINT REPAIR. THE LIMITS INDICATED ON PLANS, MAY BE REVISED AFTER REMOVAL OF EXISTING ASPHALT.
5. REMOVE AND REPLACE EXISTING IRON FENCE
6. FIELD VERIFY LOCATION OF EXISTING UTILIT
7. REPAIR EXISTING CONCRETE CURB
8. REPAIR PER STREET CUT ORDINANCE SEE COH STANDARD DETAIL: 02-02-01 & 02, 02951-01,02, & 03, 02754-01, 02752-02, 02775-02
9. PROP. SEAL COAT ON EXISTING ASPHALT PAVEMENT
10. MATCH EXISTING PAVING ELEVATION
11. EXISTING METAL RAIL GATE TO REMAIN
12. REMOVE AND REPLACE EXISTING CONCRETE MEDIAN (SEE DETAIL SHT 22)
13. PROP U.G. CONDUIT (SEE ELECTRICAL PLAN)
14. REMOVE AND RE-INSTALL PARKING METERS
15. REPAIR EXISTING CONCRETE MEDIAN, CURB AND GUTTER (SEE DETAIL SHEET 22)

PROPOSED WHEEL STOP
PROPOSED HANDICAP PARKING SIGN
PROPOSED SAW-CUT
POINT REPAIR AREA
LIMITS OF PROPOSED PAVING
TP=47.15 PROPOSED TOP OF PAVEMENT ELEVATION
G=47.15 PROPOSED GUTTER ELEVATION
PROPOSED ELECTRICAL JUNCTION BOX (SEE ELECTRICAL PLANS)
PAINT BRIDGE CONCRETE COLUMNS AS PER SPECIFICATIONS. COLOR TO BE SELECTED DURING CONSTRUCTION

ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9204 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S):

STATE OF TEXAS
LICENSED
19 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER
SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777.
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LONE STAR NOTIFICATION 713-223-4567

Date:
CenterPoint Energy/Reliant Facilities
(Approved only for showing underground facilities, unless otherwise noted. Valid on time of issue only.)

Date:
SBC Approval for underground conduit facilities only
Signature valid for one year.

Date:
CenterPoint Energy/Gas Facilities
(Gas service lines are not shown.)

SHEET TITLE:
STRIPING AND POINT REPAIR LAYOUT
STA 23+75 TO STA 27+10
AUSTIN TO LA BRANCH

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
PROJECT MANAGER
PROGRAM & TRANSPORTATION
DIRECTOR
PUBLIC WORKS & ENGINEERING
DIRECTOR
DIRECT & DRAWN

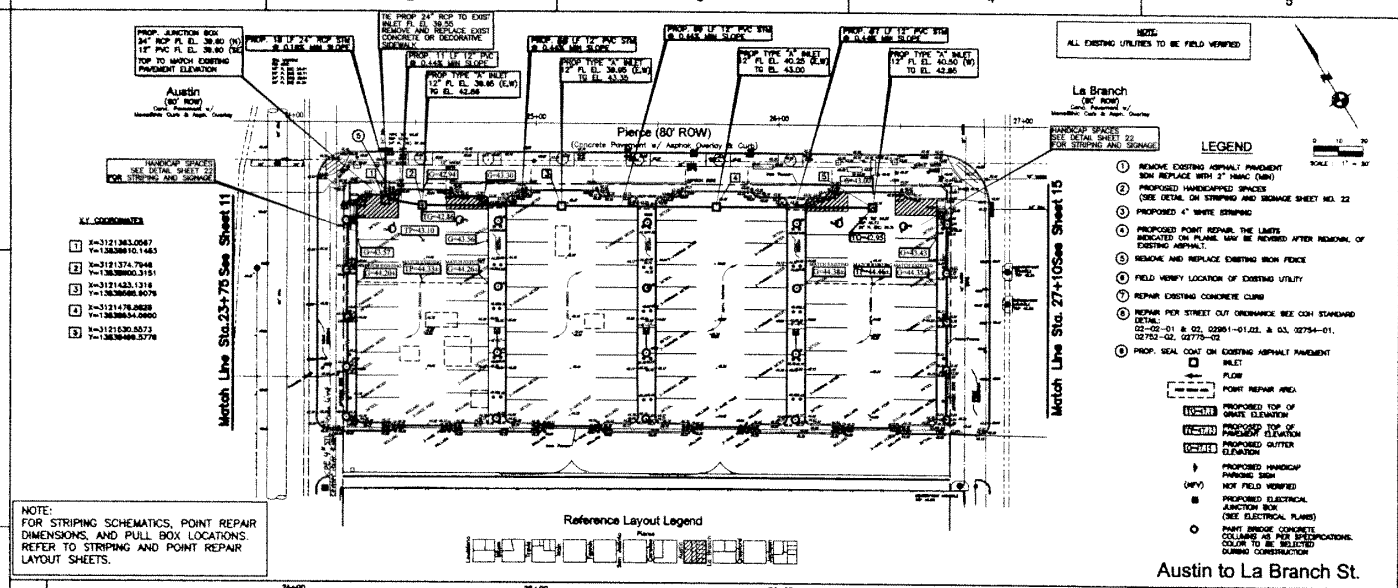
FILE NO:
FOR CITY OF HOUSTON USE ONLY

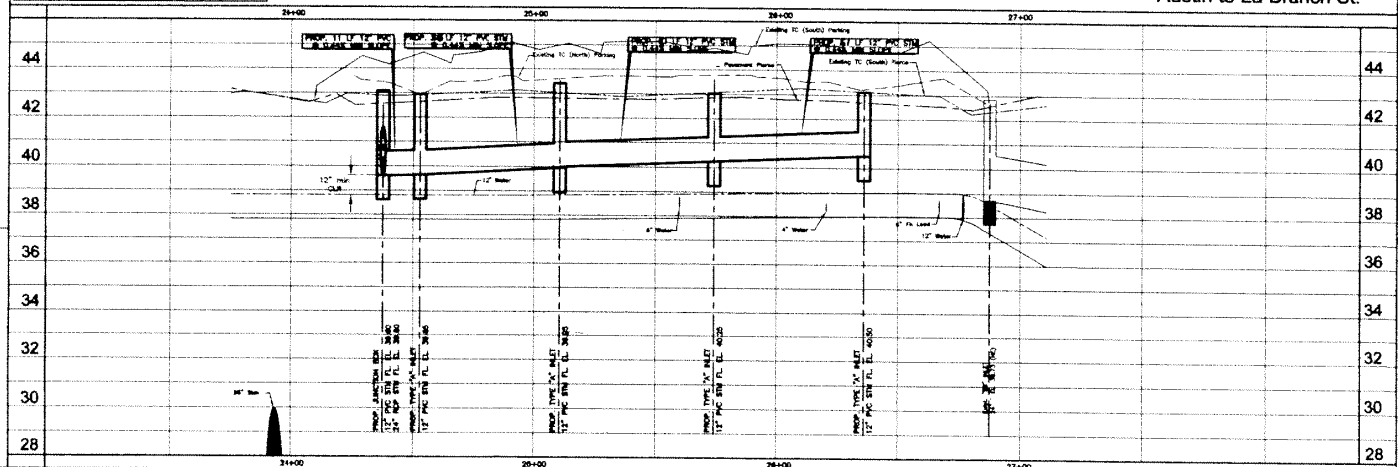
DRAWING SCALE
HORZ: HORZ: 1"=10'
VERT:

SHEET No. 12 OF 29

CITY DWG. NO.:
REVISED JAN 2008

DESIGN FILE XXXXXXXX.dwg





ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-2364 • Fax: 713-622-9262 • www.claunchmiller.com

SEAL(S):

STATE OF TEXAS
MICHAEL L. MILLER
9 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

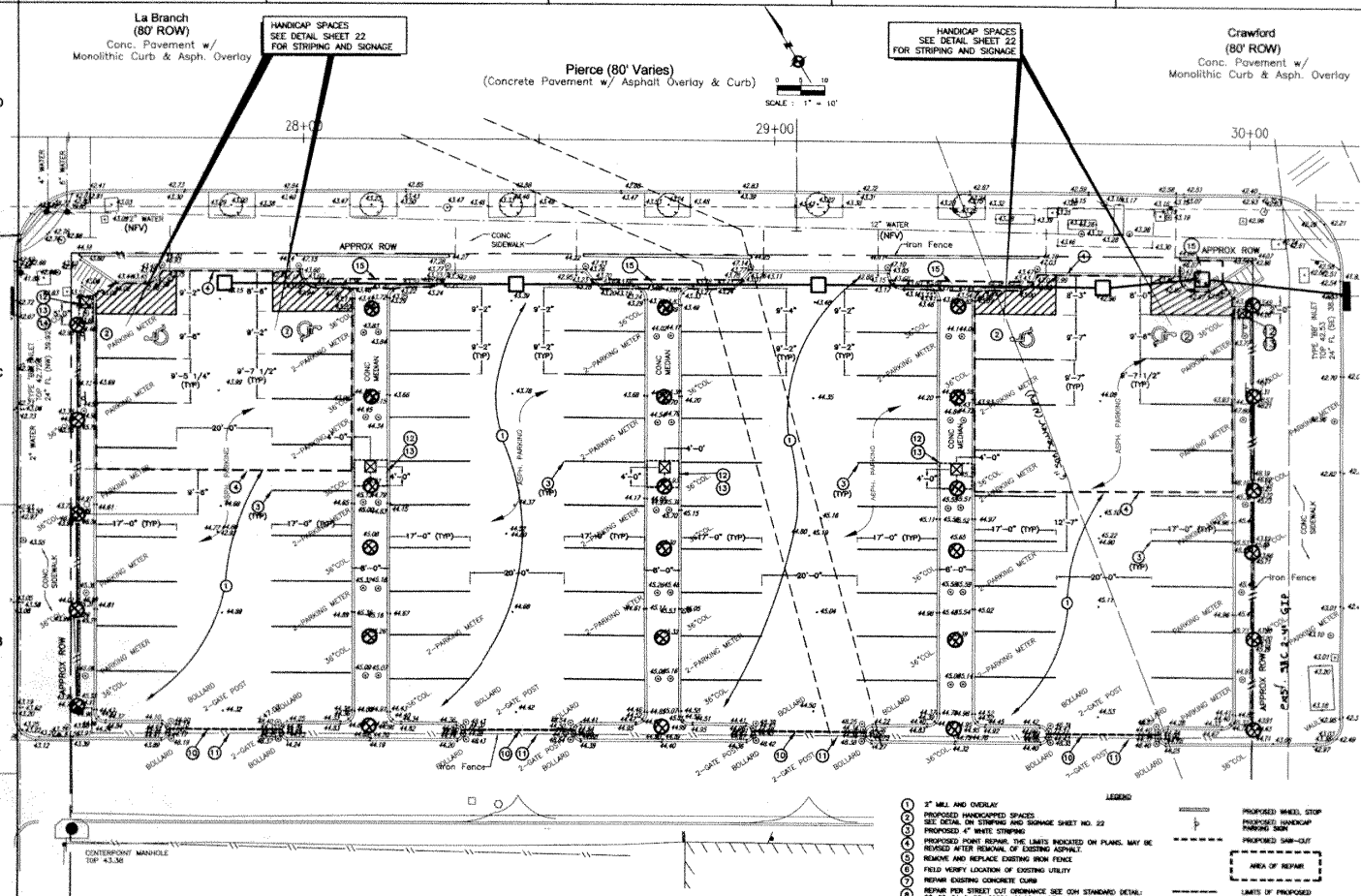
REVIEWED:

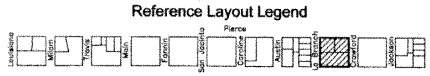
PRIVATE UTILITY LINES SHOWN

SHEET TITLE:
PLAN AND PROFILE
STA 23+75 TO STA 27+10
AUSTIN TO LA BRANCH

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:
FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ: HORZ: 1"=30
VERT: VERT. 1"=2
SHEET No. 13 OF 29
CITY DWG. NO.:
REVISED JAN 2006





LEGEND

1. 2" MILL AND OVERLAY
2. PROPOSED HANDICAPPED SPACES SEE DETAIL ON STRIPING AND SIGNAGE SHEET NO. 22
3. PROPOSED 4" WHITE STRIPING
4. PROPOSED POINT REPAIR. THE LIMITS INDICATED ON PLANS. MAY BE REVISED AFTER REMOVAL OF EXISTING ASPHALT.
5. REMOVE AND REPLACE EXISTING IRON FENCE
6. FIELD VERIFY LOCATION OF EXISTING UTILITY
7. REPAIR EXISTING CONCRETE CURB
8. REPAIR PER STREET CUT ORDINANCE SEE COH STANDARD DETAIL: 02-02-01 & 02, 02661-01,02, & 03, 02754-01, 02752-02, 02775-02
9. PROP. SEAL COAT ON EXISTING ASPHALT PAVEMENT
10. MATCH EXISTING PAVING ELEVATION
11. EXISTING METAL RAIL GATE TO REMAIN
12. REMOVE AND REPLACE EXISTING CONCRETE MEDIAN (SEE DETAIL SHT 22)
13. PROP U.G. CONDUIT (SEE ELECTRICAL PLAN)
14. REMOVE AND RE-INSTALL PARKING METERS
15. REPAIR EXISTING CONCRETE MEDIAN, CURB AND GUTTER (SEE DETAIL SHEET 22)

PROPOSED WHEEL STOP
PROPOSED HANDICAP PARKING SIGN
PROPOSED SAW-CUT
AREA OF REPAIR
LIMITS OF PROPOSED PAVING
TP=47.15 PROPOSED TOP OF PAVEMENT ELEVATION
G=47.15 PROPOSED GUTTER ELEVATION
PROPOSED ELECTRICAL JUNCTION BOX (SEE ELECTRICAL PLANS)
PAINT BRIDGE CONCRETE COLUMNS AS PER SPECIFICATIONS. COLOR TO BE SELECTED DURING CONSTRUCTION

ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S) :

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-8264 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S) :

19 May 08

PROJECT NAME :
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

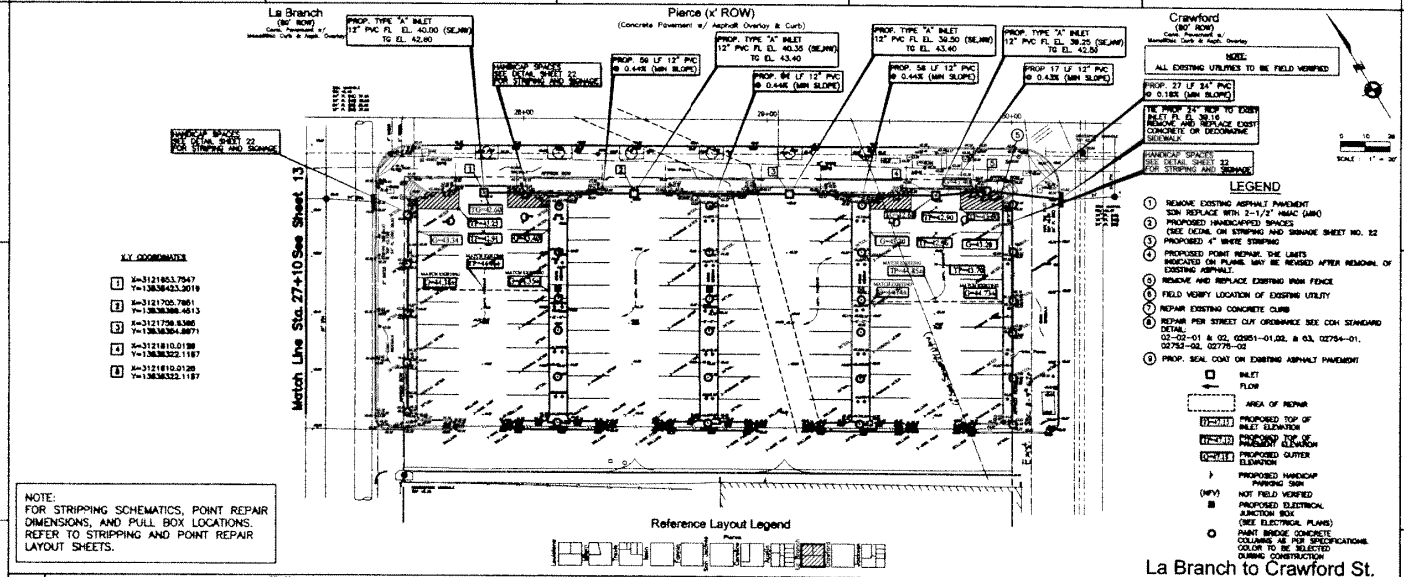
REVIEWED :

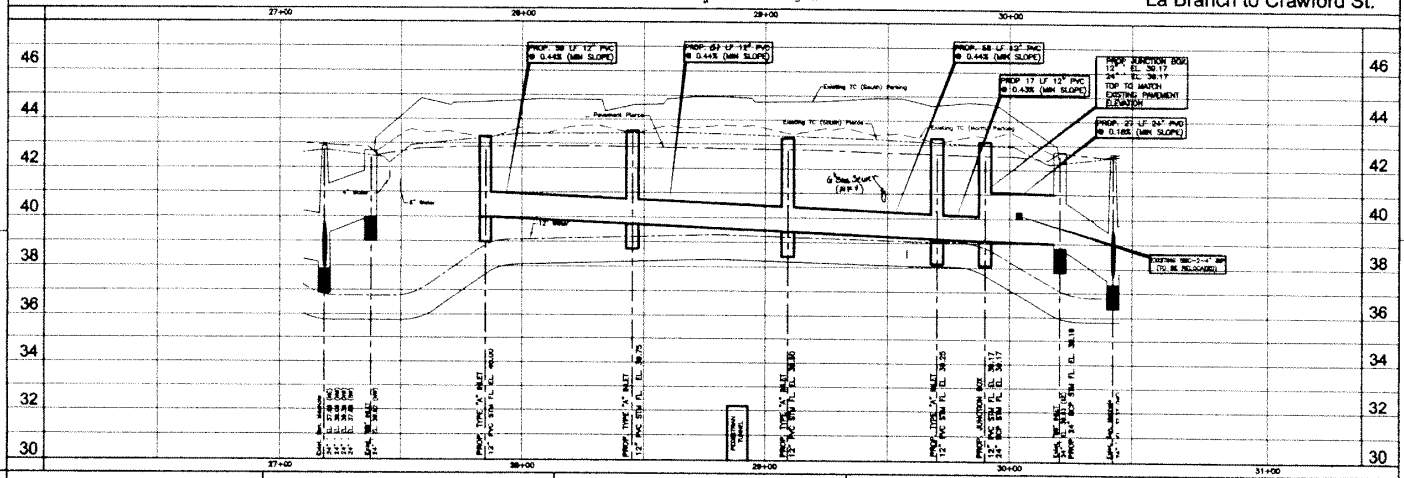
PRIVATE UTILITY LINES SHOWN

SHEET TITLE :
STRIPING AND POINT REPAIR LAYOUT
STA 27+10 TO STA 30+45
LA BRANCH TO CRAWFORD

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:
FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ : HORZ: 1"=20
VERT :
SHEET No: 14 OF 29
CITY DWG. NO. :
REVISED JAN 2006





ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants

SEAL(S):

19 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PRIVATE UTILITY LINES SHOWN

SHEET TITLE:

PLAN AND PROFILE
STA 27+10 TO STA 30+45
LA BRANCH TO CRAWFORD

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

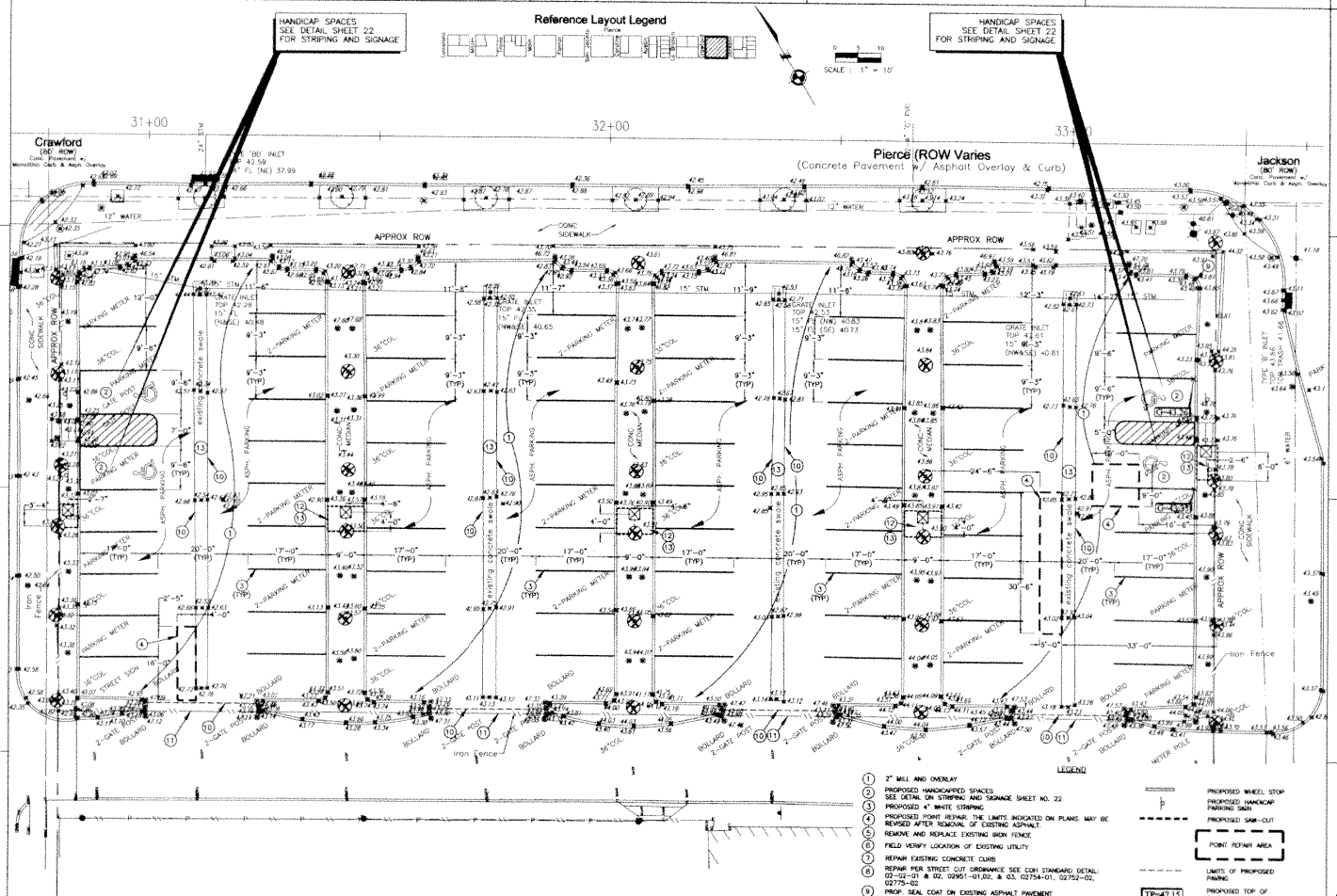
FILE NO:

DRAWING SCALE
HORZ: HORZ: 1"=20'
VERT: VERT: 1"=2'

SHEET No. 15 OF 29

CITY DWG. NO.:

REVISED JAN 2006



ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S) :

CLAUNCH & MILLER, INC.
Engineering Consultants
9635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S) :

STATE OF TEXAS — WILLIAM J. BARTON — 19 May 08

PROJECT NAME :
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED :

PROGRAM MANAGER | SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL 264-7339(ONT) AT 713-207-1771.
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LINE LOCATE DEPARTMENT AT 713-521-4867.

Date
Centerpoint Energy/Electric Facilities
Approved only for crossing underground facilities, unless otherwise noted. Valid for time of review only.

Date
SBC Approved for underground conduit facilities only. Signature valid for one year.

Date
Centerpoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE :
STRIPING AND POINT REPAIR LAYOUT
STA 30+70 TO STA 33+55
CRAWFORD TO JACKSON

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
DIRECTOR, PUBLIC WORKS & TRANSPORTATION
DATE
CITY ENGINEER
DATE
SUBMITTED
SUBMITTED
SHEET & BRIDGE

FILE NO:
FOR CITY OF HOUSTON USE ONLY

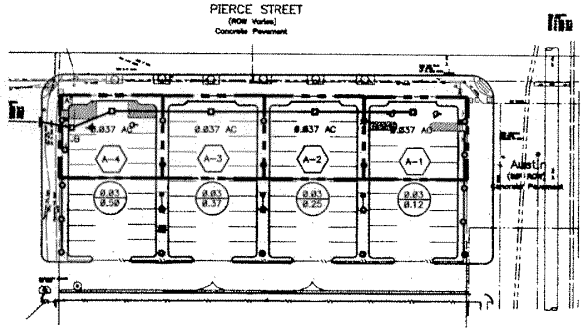
DRAWING SCALE
HORZ : 1"=10'
VERT :

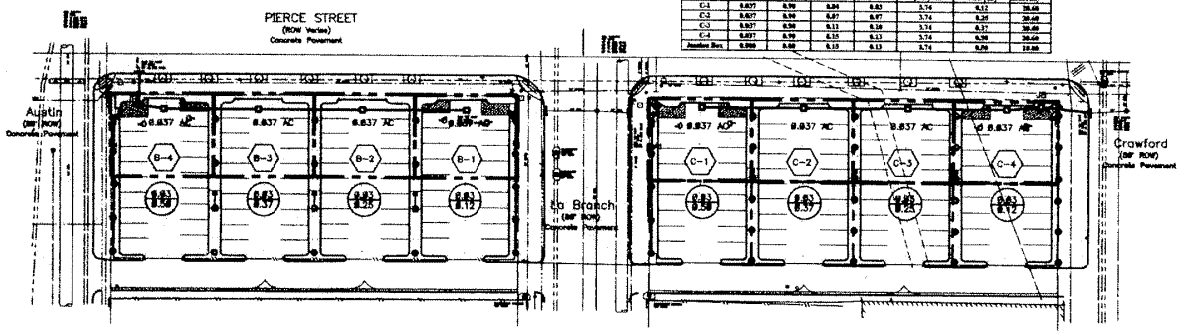
SHEET No. 16 OF 29

CITY DWG. NO. :
REVISED JAN 2006

DESIGN FILE : XXXXXXXX.dwg

DW 762 :





Pierce Elevated Parking Lot Improvements CIP2 JOB No. 87-871

DRAINAGE CALCULATIONS

City of Houston 2 year Storm (Chapter 9)

Where Time of Concentration is (TC)

TC = 18.4 $N^{0.62}$ / $i^{0.44}$ (MIN.)

and Intensity is (I)

I = b / (d + TC)^e (inches)

Rainfall Frequency		
b	e	d
75.04	0.8015	14.2

Existing Conditions Drainage Area A

Drainage Area	Area (Acres)	C (runoff coef.)	Sum. Of Area	Sum. Of C*A	I (rainfall intensity 2 year)*/hr	Sum. Of Flow (cfs)	TC (time concent.)
A-1	0.837	0.90	0.84	0.83	3.74	0.12	20.00
A-2	0.837	0.90	0.87	0.87	3.74	0.35	20.00
A-3	0.837	0.90	0.11	0.10	3.74	0.37	20.00
A-4	0.837	0.90	0.15	0.13	3.74	0.50	20.00
Junction Box	0.000	0.00	0.15	0.13	3.74	0.50	15.00

PROPOSED DRAINAGE AREA A

Drainage Area	Area (Acres)	C (runoff coef.)	Sum. Of Area	Sum. Of C*A	I (rainfall intensity 2 year)*/hr	Sum. Of Flow (cfs)	TC (time concent.)
A-1	0.837	0.90	0.84	0.83	3.74	0.12	20.00
A-2	0.837	0.90	0.87	0.87	3.74	0.25	20.00
A-3	0.837	0.90	0.11	0.10	3.74	0.37	20.00
A-4	0.837	0.90	0.15	0.13	3.74	0.50	20.00
Junction Box	0.000	0.00	0.15	0.13	3.74	0.50	15.00

Existing Conditions Drainage Area B

Drainage Area	Area (Acres)	C (runoff coef.)	Sum. Of Area	Sum. Of C*A	I (rainfall intensity 2 year)*/hr	Sum. Of Flow (cfs)	TC (time concent.)
B-1	0.837	0.90	0.84	0.83	3.74	0.12	20.00
B-2	0.837	0.90	0.87	0.87	3.74	0.25	20.00
B-3	0.837	0.90	0.11	0.10	3.74	0.37	20.00
B-4	0.837	0.90	0.15	0.13	3.74	0.50	20.00
Junction Box	0.000	0.00	0.15	0.13	3.74	0.50	15.00

PROPOSED DRAINAGE AREA B

Drainage Area	Area (Acres)	C (runoff coef.)	Sum. Of Area	Sum. Of C*A	I (rainfall intensity 2 year)*/hr	Sum. Of Flow (cfs)	TC (time concent.)
B-1	0.837	0.90	0.84	0.83	3.74	0.12	20.00
B-2	0.837	0.90	0.87	0.87	3.74	0.25	20.00
B-3	0.837	0.90	0.11	0.10	3.74	0.37	20.00
B-4	0.837	0.90	0.15	0.13	3.74	0.50	20.00
Junction Box	0.000	0.00	0.15	0.13	3.74	0.50	15.00

Existing Conditions Drainage Area C

Drainage Area	Area (Acres)	C (runoff coef.)	Sum. Of Area	Sum. Of C*A	I (rainfall intensity 2 year)*/hr	Sum. Of Flow (cfs)	TC (time concent.)
C-1	0.837	0.90	0.84	0.83	3.74	0.12	20.00
C-2	0.837	0.90	0.87	0.87	3.74	0.25	20.00
C-3	0.837	0.90	0.11	0.10	3.74	0.37	20.00
C-4	0.837	0.90	0.15	0.13	3.74	0.50	20.00
Junction Box	0.000	0.00	0.15	0.13	3.74	0.50	15.00

PROPOSED DRAINAGE AREA C

Drainage Area	Area (Acres)	C (runoff coef.)	Sum. Of Area	Sum. Of C*A	I (rainfall intensity 2 year)*/hr	Sum. Of Flow (cfs)	TC (time concent.)
C-1	0.837	0.90	0.84	0.83	3.74	0.12	20.00
C-2	0.837	0.90	0.87	0.87	3.74	0.25	20.00
C-3	0.837	0.90	0.11	0.10	3.74	0.37	20.00
C-4	0.837	0.90	0.15	0.13	3.74	0.50	20.00
Junction Box	0.000	0.00	0.15	0.13	3.74	0.50	15.00

LEGEND

- DRAINAGE AREA BOUNDARY
- A-1 — DRAINAGE AREA
- 5.55 cfs — DRAINAGE AREA (AC.) / PROP. STORM SEWER SYSTEM SUM OF FLOW (cfs)
- FLOW DIRECTION ARROWS
- I2 — INLET NAME
- MH I2 — MANHOLE NAME
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING MANHOLE
- EXISTING "I" INLET
- EXISTING "B" INLET
- EXISTING "BBF" INLET
- PROPOSED "A" INLET

0 30 60

1" = 30'

ISSUE LOG		
NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
9615 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-627-9364 • Fax: 713-627-9365 • www.claunchmiller.com

SEAL(S):

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PRIVATE UTILITY LINES SHOWN

SHEET TITLE:
DRAINAGE AREA AND CALCULATIONS

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:

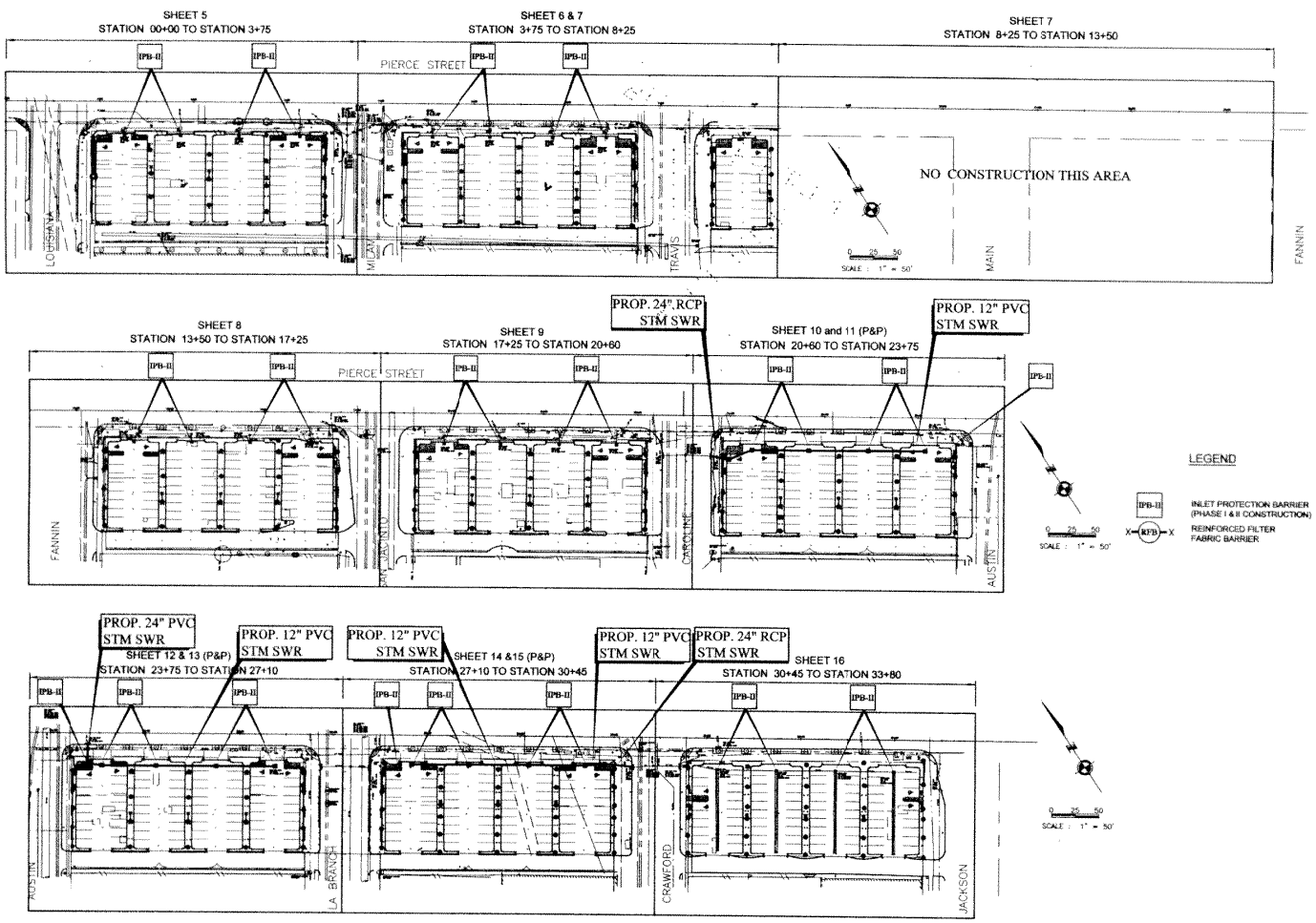
FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORZ: 1"=30'
VERT:

SHEET No. 17 OF 29

CITY DWG. NO.:

REVISED JAN 2000



ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S) :

CLAUNCH & MILLER, INC.
Engineering Consultants
4613 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S) :

STATE OF TEXAS
MARK LEONARD MILLER
LICENSED
PROFESSIONAL ENGINEER
9 MAY 08

PROJECT NAME :
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED :

PROGRAM MANAGER — SPONSORING DEPARTMENT

PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LONE STAR NOTIFICATION 713-223-4087

Date
CenterPoint Energy/Electric Facilities
Approved only for crossing underground facilities, unless otherwise noted at time of review only.

Date
SBC Approved for underground conduit facilities only
Signature valid for one year

Date
CenterPoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE :

SWPPP
SHEET I

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY
NOTE: DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:

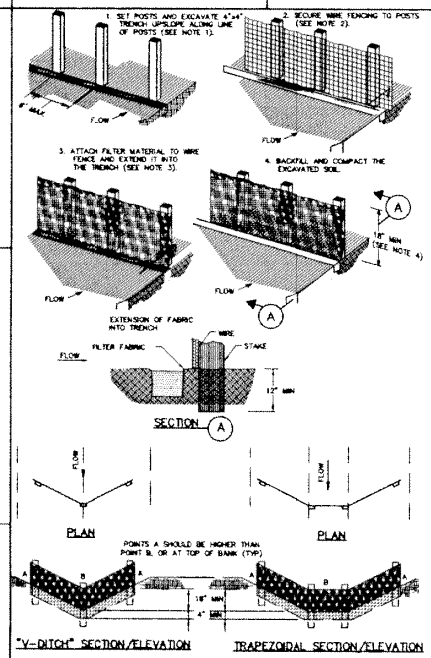
FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORZ : 1"=50'
VERT :

SHEET No: 18 OF 29

CITY DWG. NO.:

REVISED JAN 2006

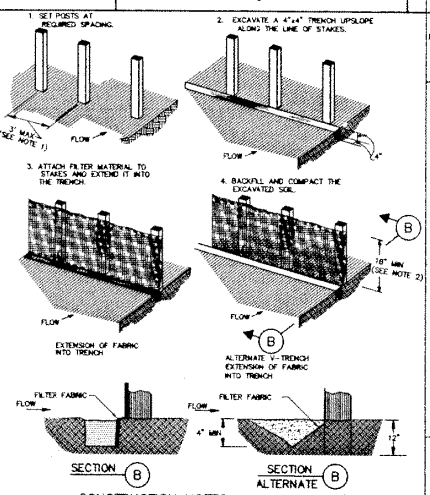


CONSTRUCTION NOTES:

1. SET 2 INCH BY 2 INCH WOODEN STAKES SPACED A MAX OF 6 FEET APART AND EMBEDDED A MIN OF 12 INCHES.
2. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH STAPLES.
3. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE, WITH TIES SPACED EVERY 24 INCHES AT TOP AND MIDSECTION.
4. MINIMUM HEIGHT OF FILTER SHOULD BE 16 INCHES AND A MAXIMUM OF 36 INCHES ABOVE NATURAL GROUND.
5. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED 6 INCHES AT THE POSTS, AND FOLDED.
6. SEE SPECIFICATION FOR FILTER FABRIC BARRIER.

X — RFB — X
SYMBOL

REINFORCED FILTER FABRIC BARRIER

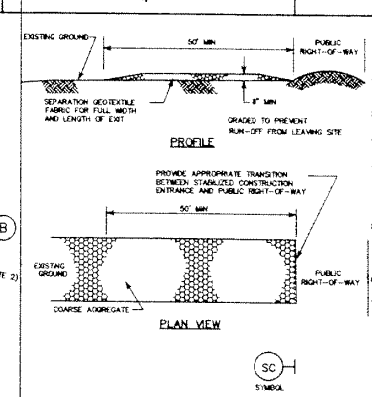


X — FF — X
SYMBOL

CONSTRUCTION NOTES:

1. 2 INCH THICK BY 2 INCH WOODEN STAKES TO BE SET AT MAX SPACING OF 3 FEET AND EMBEDDED A MIN OF 6 INCHES. IF PREASSEMBLED FENCE WITH SUPPORT NETTING IS USED, SPACING OF POST MAY BE INCREASED TO 8 FEET MAX.
2. ATTACH FILTER FABRIC TO WOODEN STAKES. FILTER FABRIC FENCE SHALL HAVE A MIN HEIGHT OF 18 INCHES AND MAX HEIGHT OF 36 INCHES ABOVE NATURAL GROUND.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHOULD BE OVERLAPPED 6 INCHES AT THE POSTS, AND FOLDED.
4. SEE SPECIFICATION FOR FILTER FABRIC FENCE.

FILTER FABRIC FENCE



SC
SYMBOL

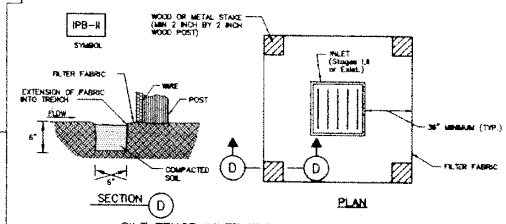
STABILIZED CONSTRUCTION EXIT

CONSTRUCTION NOTES:

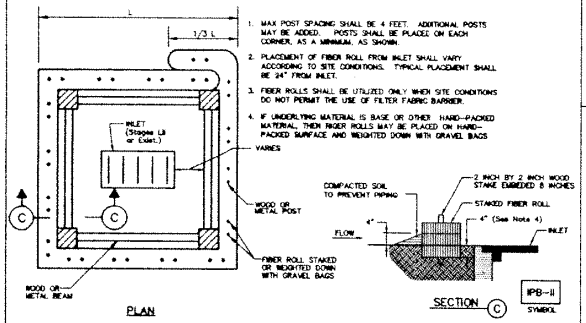
1. LENGTH SHALL BE AS SHOWN ON THE CONSTRUCTION DRAWINGS, BUT NOT LESS THAN 50 FEET.
2. THICKNESS SHALL BE NOT LESS THAN 8 INCHES.
3. WIDTH SHALL BE NOT LESS THAN FULL WIDTH OF ALL POINTS OF INGRESS OR EGRESS.
4. STABILIZATION FOR OTHER AREAS SHALL HAVE THE SAME AGGREGATE THICKNESS AND WIDTH REQUIREMENTS AS THE STABILIZED CONSTRUCTION EXIT, UNLESS OTHERWISE SHOWN ON THE CONSTRUCTION DRAWINGS.
5. STABILIZED AREA MAY BE WIDENED OR LENGTHENED TO ACCOMMODATE A TRUCK WASHING AREA. AN OUTLET SEDIMENT TRAP MUST BE PROVIDED FOR THE TRUCK WASHING AREA.
6. SEE SPECIFICATION FOR STABILIZED CONSTRUCTION EXIT.
7. STABILIZED CONSTRUCTION EXIT SHALL BE MAINTAINED FREE OF SEDIMENT FOR THE DURATION OF THE PROJECT.

CONSTRUCTION NOTE:

1. MAX. POST SPACING SHALL BE 4 FEET. ADDITIONAL POSTS MAY BE ADDED. POSTS SHALL BE PLACED ON EACH CORNER, AS A MINIMUM, AS SHOWN.
2. PLACEMENT OF FILTER FABRIC BARRIER FROM INLET SHALL VARY ACCORDING TO SITE CONDITIONS. TYPICAL PLACEMENT SHALL BE 30" MINIMUM FROM INLET EDGE.

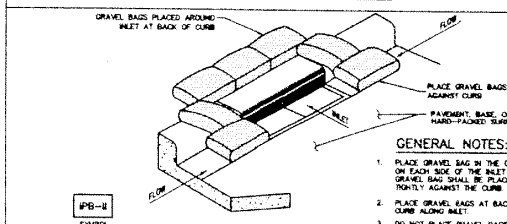


SILT FENCE INLET PROTECTION BARRIER



1. MAX POST SPACING SHALL BE 4 FEET. ADDITIONAL POSTS MAY BE ADDED. POSTS SHALL BE PLACED ON EACH CORNER, AS A MINIMUM, AS SHOWN.
2. PLACEMENT OF FIBER ROLL FROM INLET SHALL VARY ACCORDING TO SITE CONDITIONS. TYPICAL PLACEMENT SHALL BE 24" FROM INLET.
3. FIBER ROLLS SHALL BE UTILIZED ONLY WHEN SITE CONDITIONS DO NOT PERMIT THE USE OF FILTER FABRIC BARRIER.
4. IF UNDERLYING MATERIAL IS BASE OR OTHER HARD-PACKED MATERIAL, THEN FIBER ROLLS MAY BE PLACED ON HARD-PACKED SURFACE AND WEIGHTED DOWN WITH GRAVEL BAGS

FIBER ROLL INLET PROTECTION BARRIER



GENERAL NOTES:

1. PLACE GRAVEL BAG IN THE GUTTER ON EACH SIDE OF THE INLET OPENING. GRAVEL BAG SHALL BE PLACED TIGHTLY AGAINST THE CURB.
2. PLACE GRAVEL BAGS AT BACK OF CURB ALONG INLET.
3. DO NOT PLACE GRAVEL BAGS TO BLOCK THROAT OF INLET, UNLESS DIRECTED BY ENGINEER.

INLET PROTECTION BARRIER
(FOR EXISTING & PROPOSED STAGE II INLETS)

ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4631 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-623-9264 • Fax: 713-623-9263 • www.launchmiller.com

SEAL(S)

19 May 08

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PRIVATE UTILITY LINES SHOWN

SHEET TITLE:

Storm Water Pollution Prevention Details I

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO:

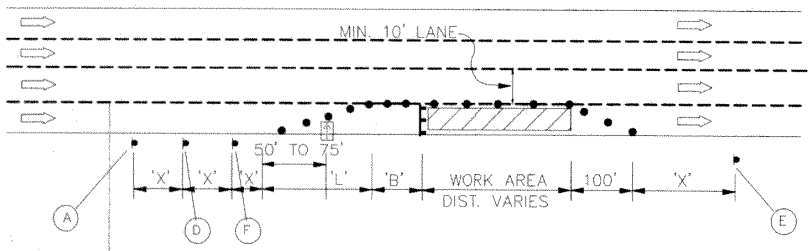
DRAWING SCALE

HOR2 : NA
VERT : NA

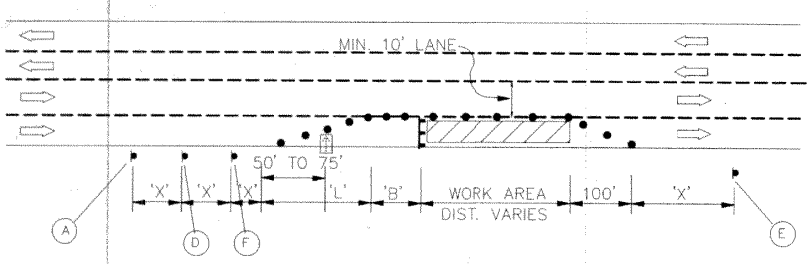
SHEET No: 19 of 29

CITY DWG. NO.:

REVISED JAN 2006



TYPICAL RIGHT LANE CLOSURE OF A MULTILANE STREET (ONE WAY)



TYPICAL RIGHT LANE CLOSURE OF A MULTILANE STREET (TWO WAY)

Length for Longitudinal Buffer	
Posted Speed (mph)	Length in Feet (B)
20	35
25	55
30	85
35	120
40	170
45	220
50	280
55	335

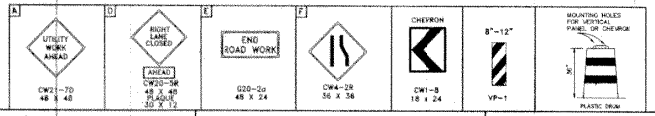
LEGEND (TYPICAL)

- PLASTIC DRUM (see spacing for channelizing devices)
- OFF-DUTY UNIFORMED POLICE OFFICER
- TYPE III BARRICADE
- FLASHING ARROW PANEL
- TUBULAR MARKER

TYPICAL SIGN SPACING AND TAPER LENGTHS.

Posted Speed (mph)	Sign Spacing "X"	Min. Desirable Taper Length "L" 10' Offset	11' Offset	12' Offset
30	120'	150'	165'	180'
35	160'	205'	225'	245'
40	240'	265'	295'	320'
45	320'	450'	495'	540'
50	400'	500'	550'	600'
55	500'	550'	605'	660'

* ENGINEER TO STRIKE THROUGH ALL SPEED LIMITS NOT APPLICABLE



SPECIAL TRAFFIC REQUIREMENTS

1. Contractor shall provide and install traffic control devices in conformance with part VI of the Texas Manual on Uniform Traffic Control Devices (Texas MUTCD, most recent edition with revisions) during construction.
2. Contractor will be responsible for replacing and maintaining pavement markings which include centerline, barrier lines, lane lines and raised pavement markings.
3. This traffic control plan represents the minimum required by traffic conditions in the field. Contractor to maintain access to adjacent properties at all times.
4a. No lanes shall be closed from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. Monday thru Friday.
4b. No lanes shall be blocked between 7:00 a.m. to 6:00 p.m. Monday thru Friday in downtown area. Exception to these times, if necessary, should be sought during lane closure permit application.
5. Contractor shall cover open pavement excavations with anchored steel plates during non-working hours, and open lanes for normal traffic flow.
6. Off-duty Uniformed Police Officers are required to direct traffic when lanes are blocked.
7. Lane closure time(s) shall be specified on the lane closure permit.
8. If the contractor chooses to use a different method of "Traffic Control Plans" during the construction than what is outlined in the contract drawings, they shall be responsible to prepare and submit an alternate set of plans* to Plan Review Section for approval ten working days prior to implementation.
   *These plans shall be drawn to scale on reproducible mylars and sealed by a Licensed Engineer in the State of Texas. Plans will become a part of the contract drawings.
9. Approved copies of Traffic Control Plans and lane closure permits shall be available for inspection at job site at all times. Contractor must secure 'Lane Closure Permits' from City's Traffic Management and Maintenance Branch before closing a lane/sidewalk. The request must be made at least three business days prior to the date for which the closure is sought. Note that working hours may be restricted or the request may be denied. Call 713-837-7280 for an application.
10. Lanes shall be kept closed during pavement surface restoration and opened only after pavement is restored completely.

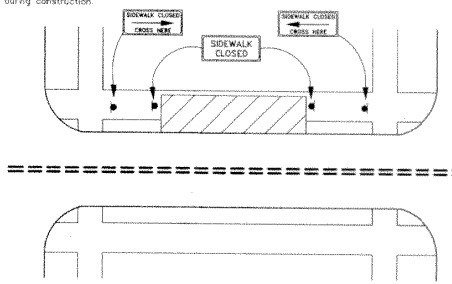
SPACING FOR CHANNELIZING DEVICES

1. Plastic drums on merging taper @ 30' c-c with chevron sign @ 60' c-c and type 'C' warning light (for overnight closure)
2. Plastic drums on downstream taper @ 35' c-c
3. Plastic drums on radii @ 5' c-c
4. Plastic drums on tangent @ 35' c-c with vertical panel @ 70' c-c and type 'C' warning light @ 70' c-c (for overnight closure)
5. Plastic drums in front of construction zone @ 20' c-c with vertical panel @ 40' c-c and Type 'A' warning light @ 40' c-c (for overnight closure)
6. Concrete traffic barrier (CTB) or low profile concrete traffic barrier (lpctb) with reflectors @ 10' c-c if pavement drop is more than twelve inches (12")
7. Tubular marker @ 20' C-C.

Note: Spacing shown on traffic control plans shall supersede the above spacings.

SIDEWALK DETOUR

1. Contractor shall provide and install traffic control devices in conformance with the Texas Manual on Uniform Traffic Control Devices (Texas MUTCD, most recent edition with revisions) during construction.



AS REQUIRED	30 MPH
STREET NAME	SPEED LIMIT

ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-5264 • Fax 713-622-3365 • www.clauncheandmiller.com

SEAL(S): STATE OF TEXAS — GUILLERMO G. SALCEDO — 22 Jan 10

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS, CALL THE LONE STAR NOTIFICATION 713-223-4567.

N/A — Date:
CenterPoint Energy/Electric Facilities
Approval only for crossing underground facilities, unless otherwise noted. Valid up to one (1) year only.

N/A — Date:
SBC Approval for underground conduit facilities only.
Approval valid for one year.

N/A — Date:
CenterPoint Energy/Gas Facilities
Gas service lines are not allowed.

SHEET TITLE:
TRAFFIC CONTROL PLAN
SHEET 1

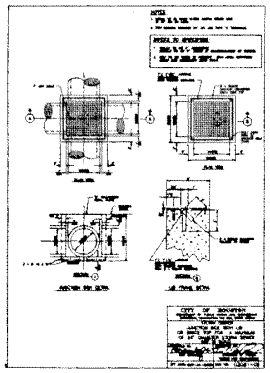
NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

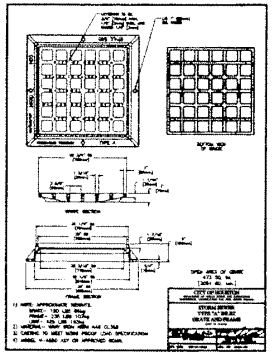
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

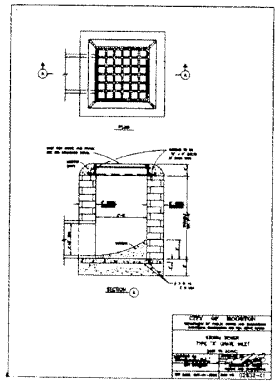
DIRECTOR — TRAFFIC & TRANSPORTATION
MANAGER — STORM WATER QUALITY
STORM — FACILITIES
STREET & DRAINAGE

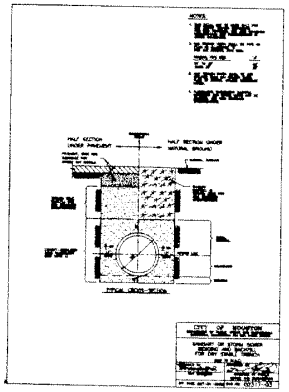
FILE NO: — FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE:
HORZ: NA
VERT:
SHEET No. 20 OF 29

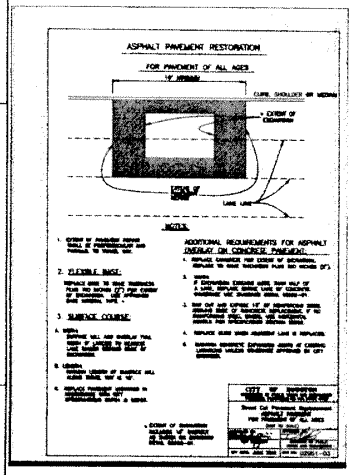
CITY DWG. NO.: — REVISED JAN 2006

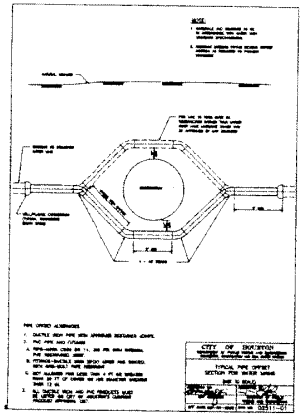


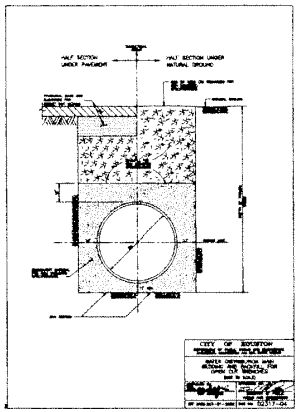


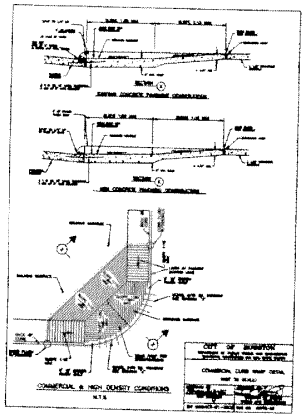


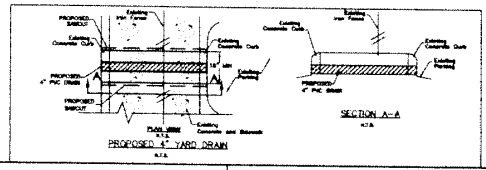












ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants

SEAL(S):

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PRIVATE UTILITY LINES SHOWN

SHEET TITLE:
General Details 1 of 2

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO.:

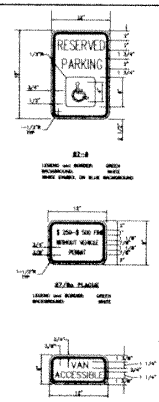
DRAWING SCALE
HORIZ: N/A
VERT: N/A

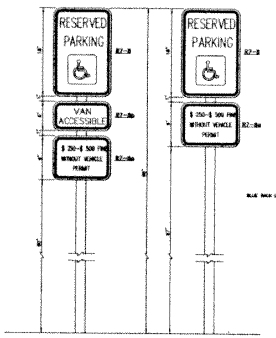
SHEET No: 21 of 29

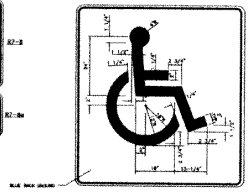
CITY DWG. NO.:

REVISED JAN 2006

334 of 350



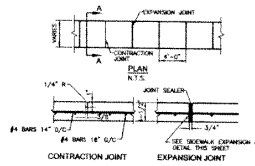




NOTES:

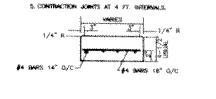
1. ALL PARKING SPACE/AIRT LINES SHALL BE 4" SOLID WHITE LINES.
2. AISLE MARKINGS SHOWN ARE EXAMPLES ONLY. OTHER METHODS TO INDICATE A NO PARKING AREA ARE ACCEPTABLE. AISLE MARKINGS SHALL BE WHITE.
3. DIMENSIONS OF LIMIT LINES, AISLE MARKINGS, AND SYMBOL (WITH OR WITHOUT BACKGROUND) MAY VARY ± 10%.
4. PAVEMENT MARKING SYMBOLS (WITH BACKGROUND).
   a) ARE REQUIRED UNLESS STATED ELSEWHERE IN THE PLANS.
   b) SHOULD BE PLACED TOWARD THE FAR END OF THE PARKING SPACE SO AS TO BE VISIBLE TO MOTORISTS IN THE TRAVEL LANE.
   c) MAY BE PAINTED OR PREFABRICATED MATERIAL, AND
   d) SHALL BE 30"x30" MINIMUM.
5. FROM APPROVAL OF THE ENGINEER, PREFABRICATED PAVEMENT MARKING SYMBOLS WITH BACKGROUND OF OTHER DIMENSIONS EXCEEDING THE 30"x30" MINIMUM MAY BE USED. ALTERNATIVE DETAILS SHALL INCLUDE A PROPORTION SIZED SYMBOL OF ACCESSIBILITY AND SHALL CONFORM TO THE ILLUSTRATED COLORS FOR BACKGROUND, SYMBOL AND BORDER.
6. AN R7-8 SIGN:
   a) SHALL BE REQUIRED FOR EACH ACCESSIBLE PARKING SPACE
   b) SHALL NOT BE PLACED BETWEEN TWO ACCESSIBLE PARKING SPACES.
   c) SHALL NOT BE PLACED IN A LOCATION THAT RESTRICTS MOVEMENT ON THE SIDEWALK (PEDESTRIAN TRAVEL AREA)*, SIDEWALK, AND
   d) SHALL HAVE A MINIMUM MOUNTING HEIGHT OF 7 FEET. IF MOUNTED TO WALL OR LOCATED SO AS TO NOT BE NEAR PEDESTRIAN TRAFFIC MINIMUM MOUNTING HEIGHT MAY BE 7 FEET.
7. POST MOUNTED SIGNS SHOULD BE PLACED APPROXIMATELY 1 FOOT (OR GREATER) BEHIND THE SIDEWALK CURB TO PREVENT DAMAGE FROM VEHICLE OVERHANG.
8. SIGNS MAY BE MOUNTED DIRECTLY TO AN ADJACENT WALL OF A BUILDING WHEN POST MOUNTING IS IMPRACTICAL.

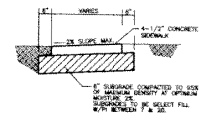
METRO STANDARD
PAVEMENT MARKINGS AND SIGNAGE
FOR HANDICAPPED ACCESSIBLE PARKING
N.T.S.



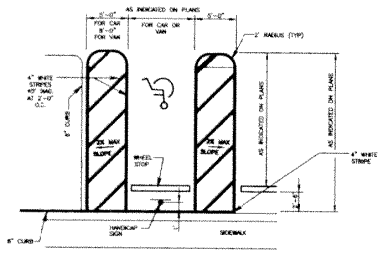
NOTES:

1. ALL EDGES SHALL BE ROUNDED WITH 1/4" RADIUS.
2. EXPANSION MATERIAL WITH 1/2" DOWELS @ 18" O-C SHALL BE PLACED AT 20 FT. INTERVALS BETWEEN NEW SIDEWALKS, BUILDINGS, CURBS, DRIVEWAYS, OR PLACES SHOWN ON PLANS.
3. EXPANSION JOINTS WITH 1/2" DOWELS @ 18" O-C SHALL BE SPACED AT 20 FT. INTERVALS.
4. WHERE NEW SIDEWALK IS PLACED AGAINST EXISTING SIDEWALK, SAWCUT EXISTING SIDEWALK AT AN EVEN STRAIGHT LINE PRIOR TO INSTALLATION OF THE NEW SIDEWALK.
5. CONTRACTION JOINTS AT 4 FT. INTERVALS.

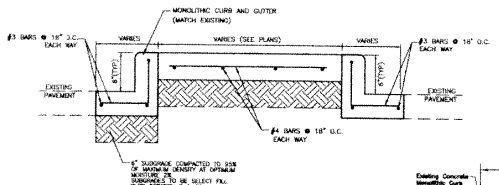




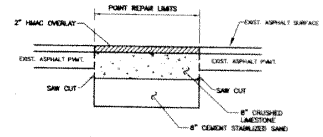
CONCRETE SIDEWALK
N.T.S.



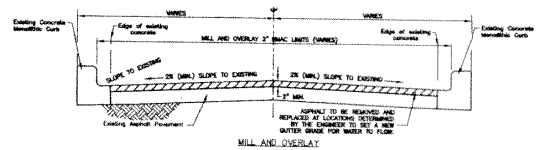
HANDICAPPED PARKING STALL (1)
N.T.S.



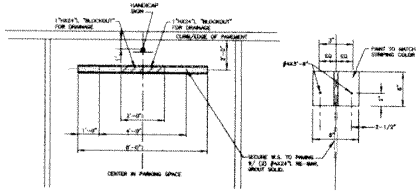
TYPICAL CURB AND MEDIAN REPAIR
N.T.S.



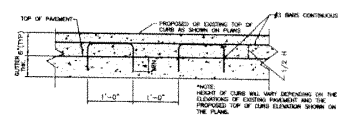
POINT REPAIR DETAIL
N.T.S.



TYPICAL PARKING OVERLAY CROSS SECTION
N.T.S.



WHEEL STOP DETAIL
N.T.S.



NOTE:
HEIGHT OF CURB WILL VARY DEPENDING ON THE ELEVATIONS OF EXISTING PAVEMENT AND THE PROPOSED TOP OF CURB ELEVATION SHOWN ON THE PLANS.

1. WHEN CURB IS TO BE REPLACED ONLY, REMOVE EXISTING CURB FROM THE TOP OF THE EXISTING PAVEMENT AND DOWEL AND GROUT REINFORCING BARS INTO EXISTING PAVEMENT.
2. DO NOT BREAK EXISTING CURB BELOW TOP OF PAVEMENT.
3. WHENEVER EXISTING CURB IS REMOVED, IT SHALL BE SAWCUT PRIOR TO REMOVAL. EXPANSION JOINT MATERIAL SHALL BE USED WHENEVER NEW CURB ABUTS EXISTING CURB.
4. CONTRACTOR IS TO PROVIDE POSITIVE DRAINAGE FLOW OVER NEWLY PROPOSED CURB AND SHALL VERIFY ADEQUATE SLOPE PRIOR TO PLACING CONCRETE.

CURB REPAIR
N.T.S.

ISSUE LOG

NO.	DATE	DESCRIPTION

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1900 • Houston, Texas 77027
713-622-9264 • Fax: 713-622-9265 • www.claunchmiller.com

SEAL(S):

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:

PROJECT MANAGER | SPONSORING DEPARTMENT

PROJECT MANAGER

TO ARRANGE FOR LINES TO BE MARKED OFF OR MOVED, CALL (24 HOURS) AT 713-307-7777

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET BLOW OR EASEMENTS CALL THE LONE STAR NOTIFICATION 713-223-4567

Date
Centerpoint Energy/Electric Facilities
(Approved only for drawing underground facilities, unless otherwise noted) valid for time of review only.

Date
NW: Approved for underground conduit facilities only. Signature valid for one year.

Date
Centerpoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE:

General Details Sheet 2 of 2

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURE

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO: | FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE:
HORZ: N/A
VERT:

SHEET No: 22 OF 29

CITY DWG. NO.: | REVISED JAN 2006

EXISTING

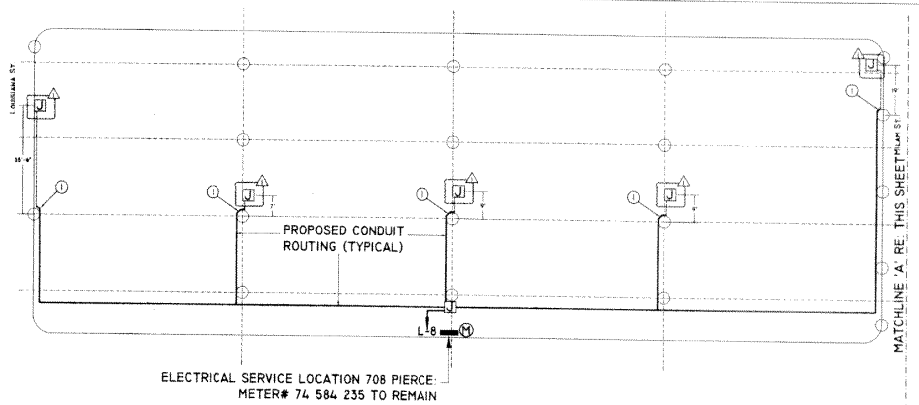
PANEL: L (SITE 1) — LOCATION: UNDER ROADWAY — MTG: ☒ SURFACE ☐ FLUSH — BUS: ☒ NEUTRAL ☐ SYS GND ☐ ISO GND — OPT: ☐ MLO ☐ PEDESTAL — MAIN: 100 AMP BUS — 100 MAIN — 100 AMP MLO — 1 Ø 3 WIRE — 240/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BRKR SIZE	CKT NO	A	C	CKT NO	BRKR SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#10	LIGHTING - UNDER ROADWAY	1.5	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.0	PAY STATIONS (METER)	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	20/1	-	SPARE	
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/1		SPARE	

CONN LTG 12 W @ 125 = 0.9 KVA — CONN EQUIP ___ W @ ___ = ___ KVA — CONN HVAC ___ W @ ___ = ___ KVA
AFTER LOAD ___ W @ ___ = ___ KVA — CONN RCPT 1500 WEC = 1.5 KVA — TOTAL LOAD 9.3 KVA — 26 AMPS

EXISTING LIGHTING LOAD ON PANEL 'L' IS 9.3 X 1.25= 11.6 KVA
NEW (ADDED) METER EQUIPMENT LOAD IS 1.0 KVA
TOTAL LOAD 12.6 KVA

(PANEL AND FEEDER ARE RATED FOR 100A)



1 145 - LOUISIANA ST. & MILAM ST.(SITE 1)
SCALE: 1/16" = 1'-0"

EXISTING

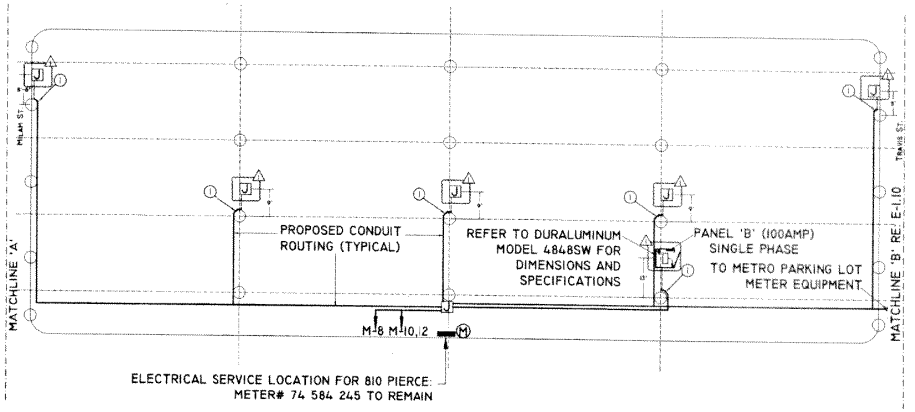
PANEL: M (SITE 2) — LOCATION: UNDER ROADWAY — MTG: ☒ SURFACE ☐ FLUSH — BUS: ☒ NEUTRAL ☐ SYS GND ☐ ISO GND — OPT: ☐ MLO ☐ PEDESTAL — MAIN: 100 AMP BUS — 100 MAIN — 100 AMP MLO — 1 Ø 3 WIRE — 240/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BRKR SIZE	CKT NO	A	C	CKT NO	BRKR SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#10	LIGHTING - UNDER ROADWAY	1.5	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.0	METER PAY STATIONS (NEW LOAD)	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	40/2	1.0	PANEL 'B' (NEW LOAD)	3#6
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	2	1.0	UNDER GUARD BOOTH	

CONN LTG 12 W @ 125 = 0.9 KVA — CONN EQUIP 12 W @ 125 = 1.5 KVA — CONN HVAC ___ W @ ___ = ___ KVA
AFTER LOAD ___ W @ ___ = ___ KVA — CONN RCPT 1500 WEC = 1.5 KVA — TOTAL LOAD 17.4 KVA — 73 AMPS

EXISTING LIGHTING LOAD ON PANEL 'M' IS 9.3 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT AND GUARD BOOTH LOAD IS 4.6 KVA
TOTAL LOAD 17.4 KVA

(PANEL AND FEEDER ARE RATED FOR 100A)



2 145 - MILAM ST. & TRAVIS ST. (SITE 2)
SCALE: 1/16" = 1'-0"

NORTH

ISSUE LOG

NO.	DATE	DESCRIPTION
1	6/3/08	CLIENT REVISIONS

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4613 Southwest Freeway, Suite 1050 • Houston, Texas 77027
713-621-9266 • Fax 713-621-9267 • www.claunchmiller.com

SEAL(S):

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
8111 SOUTHWOOD AVENUE, SUITE 100
HOUSTON, TEXAS 77074
(713) 622-1516 PH (713) 622-6557 FAX
WWW.JAINSTON.COM

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777.

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL TXU LONE STAR INTERFLEXION 713-223-4087

Date
Centerpoint Energy/Electric Facilities
(Approved only for crossing underground facilities, unless otherwise noted. Note at time of review only)

Date
SBC Approved for underground conduit facilities only
(Signature valid for one year)

Date
Centerpoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE:
E-1.00

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

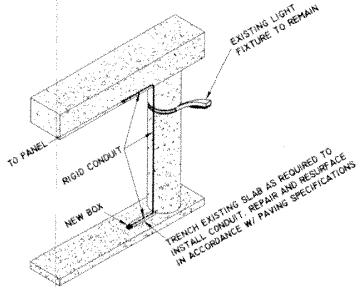
DATE — DEPUTY DIRECTOR, PUBLIC WORKS & ENGINEERING
DATE — DIRECTOR
DATE — CITY ENGINEER

FILE NO: — FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORZ.:
VERT.:

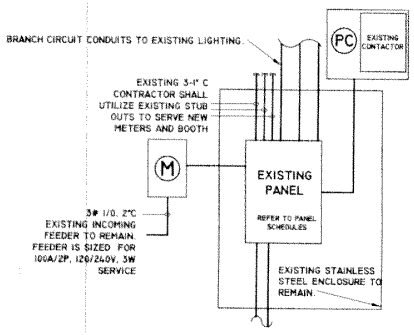
SHEET No: 24 OF 29

CITY DWG. NO.: — REVISED JAN 2000

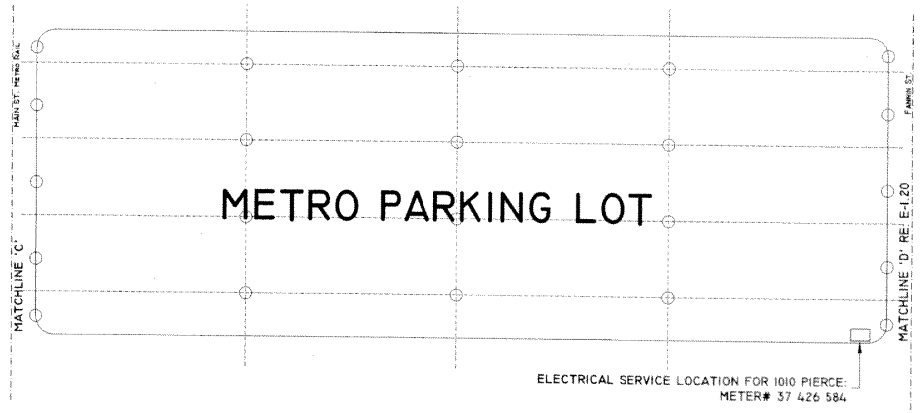


1 TYPICAL CONDUIT RUN TO JUNCTION BOX
SCALE: NTS

2 145 - TRAVIS ST. & MAIN ST.
SCALE: 1/16" = 1'-0"



3 TYPICAL SERVICE ENTRANCE DETAIL AND ONE LINE
SCALE: NTS



4 145 - MAIN ST. & FANNIN ST.
SCALE: 1/16" = 1'-0"

ISSUE LOG

NO.	DATE	DESCRIPTION
1	6/3/08	CLIENT REVISIONS

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1940 • Houston, Texas 77027
713.623.9264 • Fax 713.622.9265 • www.claunchmiller.com

SEAL(S):

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
6117 RICHMOND AVENUE, SUITE 100
HOUSTON, TEXAS 77057
(713) 622-0220 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER
SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL SEARCHPOINT AT 713-227-2722

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS, CALL THE TRAFFIC SIGNAL SUPERVISOR 713-223-4007.

N/A
Date
CenterPoint Energy/Houston Facilities
(Approved only for drawing underground facilities, unless otherwise noted. Take at time of below data)

Date
SBC Approval for underground conduit facilities only.
Signature valid for one year

N/A
Date
CenterPoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE:
E-1.10

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
NAME: TRAFFIC & TRANSPORTATION
DATE: 6/4/08
NAME: FACILITIES
DATE: 6/4/08
SIGNS
SIGNAL & SIGNAGE

FILE NO:
FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ:
VERT:
SHEET No: 25 OF 29

CITY DWG. NO.:
REVISED JAN 2008

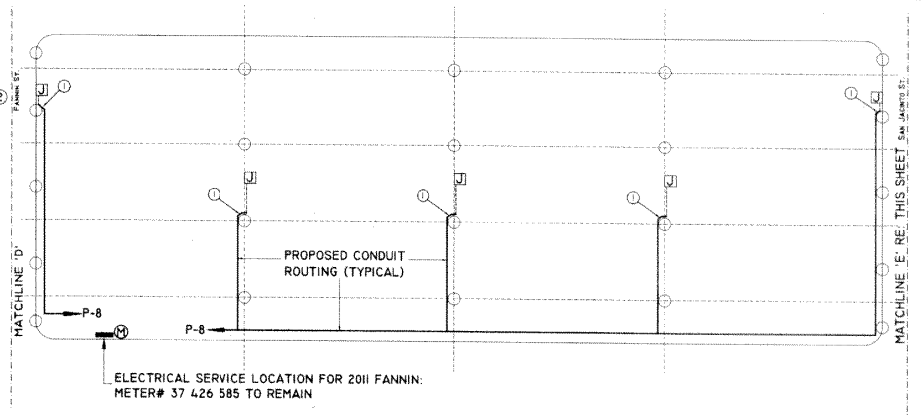
EXISTING

PANEL: P (SITE 3) — LOCATION: UNDER ROADWAY — MTG: ☒ SURFACE ☐ FLUSH — BUS: ☒ INDUSTRIAL ☒ SYS ONLY ☐ TBD ONLY — OPT: ☐ INT TYPE ☐ PEDS THRU — MAIN: 50 — MAT: — MLO: — 100 — AIC: — 10K — AMP BUS: 1 Ø 3 WIRE — AMP MLO: — AMP MCB: 20/2POLE — VOLT: 240/120

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BRKR SIZE	CKT NO	A	C	CKT NO	BRKR SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#8	LIGHTING - UNDER ROADWAY	1.6	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.0	METER PAY STATIONS (NEW LOAD)	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	20/1	-	SPARE	-
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/1	-	SPARE	-

CONN LTG 12.2 W/PH 12.6 KVA — CONV EQUIP — W/PH — KVA — CONN HVAC — W/PH — KVA
AFDR LOAD — W/PH — KVA — CONN RCPT 1.0 DMD 1.0 KVA — TOTAL LOAD 13.8 KVA 38 AMPS

EXISTING LIGHTING LOAD ON PANEL 'P' IS 10.2 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT LOAD IS 1.0 KVA
TOTAL LOAD 13.8 KVA
(PANEL AND FEEDER ARE RATED FOR 100A)



1 145 - FANNIN ST. & SAN JACINTO ST. (SITE 3)
SCALE: 1/16" = 1'-0"

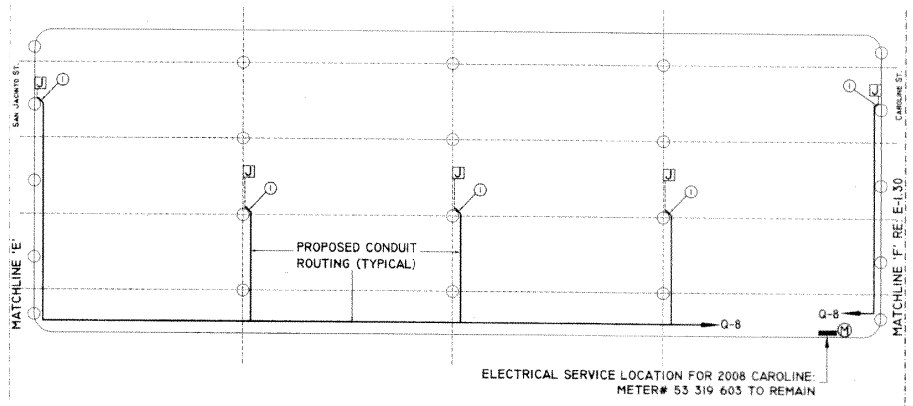
EXISTING

PANEL: Q (SITE 4) — LOCATION: UNDER ROADWAY — MTG: ☒ SURFACE ☐ FLUSH — BUS: ☒ INDUSTRIAL ☒ SYS ONLY ☐ TBD ONLY — OPT: ☐ INT TYPE ☐ PEDS THRU — MAIN: 50 — MAT: — MLO: — 100 — AIC: — 10K — AMP BUS: 1 Ø 3 WIRE — AMP MLO: — AMP MCB: 20/2POLE — VOLT: 240/120

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BRKR SIZE	CKT NO	A	C	CKT NO	BRKR SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#10	LIGHTING - UNDER ROADWAY	1.0	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.0	METER PAY STATIONS (NEW LOAD)	3#10
3#8	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	20/1	-	SPARE	-
3#8	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/1	-	SPARE	-

CONN LTG 12.2 W/PH 12.6 KVA — CONV EQUIP — W/PH — KVA — CONN HVAC — W/PH — KVA
AFDR LOAD — W/PH — KVA — CONN RCPT 1.0 DMD 1.0 KVA — TOTAL LOAD 13.8 KVA 38 AMPS

EXISTING LIGHTING LOAD ON PANEL 'Q' IS 10.2 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT LOAD IS 1.0 KVA
TOTAL LOAD 13.8 KVA
(PANEL AND FEEDER ARE RATED FOR 100A)



2 145 - SAN JACINTO ST. & CAROLINE ST. (SITE 4)
SCALE: 1/16" = 1'-0"

NORTH

ISSUE LOG

NO.	DATE	DESCRIPTION
1	6/3/08	CLIENT REVISIONS

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4623 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9364 • Fax 713-622-9265 • www.claunchandmiller.com

SEAL(S):

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
8117 RICHMOND AVENUE, SUITE 100
HOUSTON, TEXAS 77063
(713) 622-0120 Ph (713) 622-0557 FAX
WWW.IAHOUSTON.COM

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING DEPARTMENT — PROJECT MANAGER

TO ARRANGE FOR LINES TO BE BURNED OFF ON MOVED, CALL CENTERPOINT AT 713-207-7777
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL PIPE LINE STAR NOTIFICATION 713-223-4087
Date:
CenterPoint Energy/Gas Facilities
Approved only for locating underground facilities, unless otherwise noted. Valid at time of review only.
Date:
SBC Approved for underground conduit facilities only. Signature valid for one year.
Date:
CenterPoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE:
E-1.20

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
DIRECTOR, TRAFFIC & TRANSPORTATION
DATE
DESIGN
PROJECT ENGINEER
DRAWN
DRAWN & DESIGNED

FILE NO: — FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ:
VERT:
SHEET No: 26 OF 29

CITY DWG. NO.: — REVISED JAN 2008

EXISTING

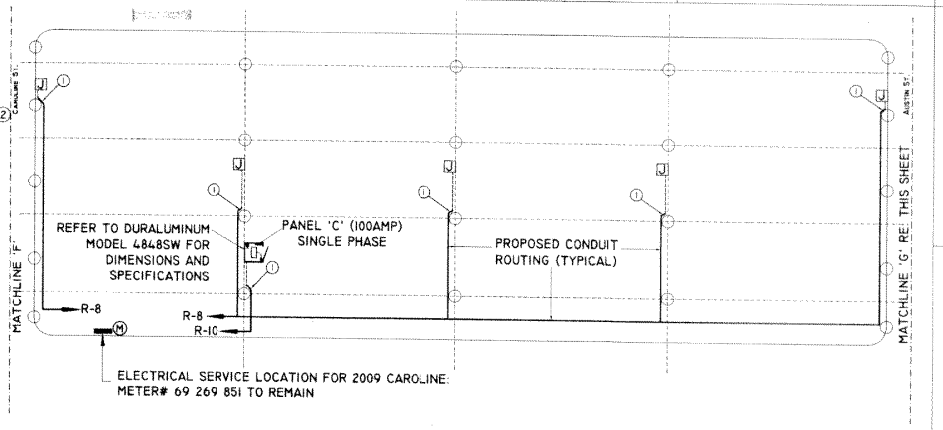
PANEL: R (SITE 5)
LOCATION: UNDER ROADWAY

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BREAKER SIZE	CKT NO	A	C	CKT NO	BREAKER SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#8	LIGHTING - UNDER ROADWAY	1.5	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.9	METER PAY STATIONS (NEW LOAD)	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	40/2	1.6	PANEL "C" (NEW LOAD)	3#6
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/2	1.5	INSIDE GUARD BOOTH	

CONN LTG 10.2 KVA CONN EQUIP 3.2 KVA CONN PWR KVA
AFTER LOAD KVA CONN MOT KVA TOTAL LOAD 17 KVA 71 AMPS

EXISTING LIGHTING LOAD ON PANEL 'R' IS 10.2 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT AND GUARD BOOTH LOAD IS 4.2 KVA
TOTAL LOAD 17.0 KVA

(PANEL AND FEEDER ARE RATED FOR 100A)



1 145 - CAROLINE ST. & AUSTIN ST. (SITE 5)
SCALE: 1/16" = 1'-0"

EXISTING

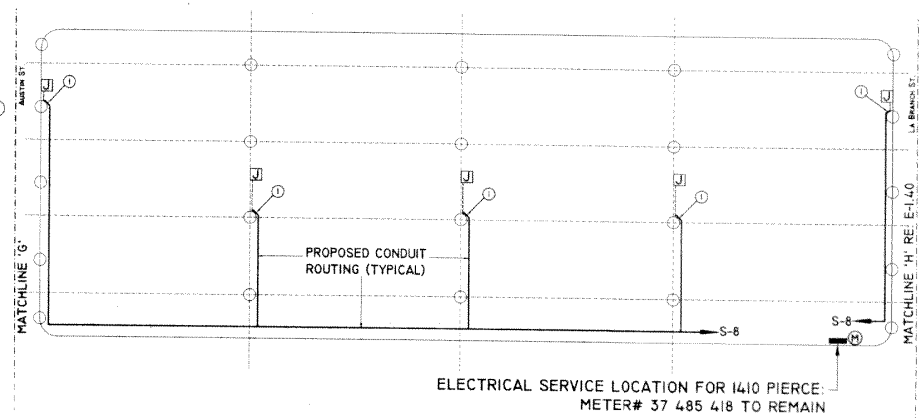
PANEL: S (SITE 6)
LOCATION: UNDER ROADWAY

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BREAKER SIZE	CKT NO	A	C	CKT NO	BREAKER SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#10	LIGHTING - UNDER ROADWAY	1.5	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.9	METER PAY STATIONS (NEW LOAD)	3#10
3#6	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	20/1		SPARE	
3#6	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/1		SPARE	

CONN LTG 7.7 KVA CONN EQUIP KVA CONN PWR KVA
AFTER LOAD KVA CONN MOT KVA TOTAL LOAD 9.6 KVA 28 AMPS

EXISTING LIGHTING LOAD ON PANEL 'S' IS 10.2 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT LOAD IS 1.9 KVA
TOTAL LOAD 15.8 KVA

(PANEL AND FEEDER ARE RATED FOR 100A)



2 145 - AUSTIN ST. & LA BRANCH ST.(SITE 6)
SCALE: 1/16" = 1'-0"

ISSUE LOG

NO.	DATE	DESCRIPTION
1	03/08	CLIENT REVISIONS

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4433 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9294 • Fax: 713-622-9263 • www.claunchmiller.com

SEAL(S):

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
5117 ROSWOND AVENUE, SUITE 106
HOUSTON, TEXAS 77057
(713) 622-0136 PH (713) 622-0567 FAX
WWW.IAHOUSTON.COM

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER
SPONSORING DEPARTMENT
PROJECT MANAGER

TO AVOID PIPE LINES TO BE BURIED OR MOVED, CALL CENTERPOINT AT 713-207-7777
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET & ALL OR CONDUITS CALL BMC CORE STAR INSTALLATION 713-523-4067

Date
Centerpoint Energy/Reliant Facilities
(Approval only for overhead underground facilities, unless otherwise noted, valid at time of review only)

Date
BMC Approved for underground conduit facilities only.
Signature valid for one year.

Date
Centerpoint Energy/Gas Facilities
(Gas service lines are not shown)

SHEET TITLE:
E-1.30

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

NAME & TRANSMITTAL

FILE NO:
FOR CITY OF HOUSTON USE ONLY

DRAWING SCALE
HORIZ:
VERT:

SHEET No: 27 OF 29

CITY DWG NO:
REVISED JAN 2002

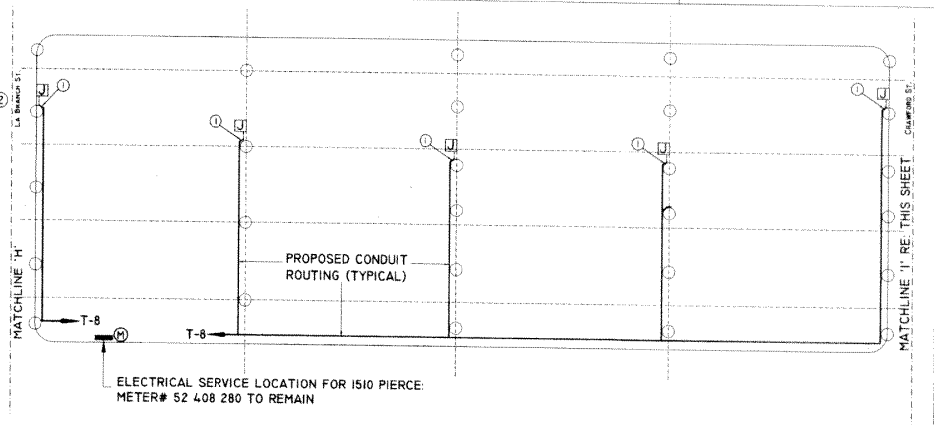
EXISTING

PANEL: T (SITE 7) MTG: ☒ SURFACE ☐ FLUSH SIZE: ☒ NEUTRAL ☒ SYS GND ☐ ISO GND OPT: ☐ INT TVSS ☐ FEED THRU DETAIL: SYM 100 AMP BUS 1 Ø 3 WIRE; CKT 32 MAT AMP MLO 70 AIC; 80 AMP MCB 240/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BRKR SIZE	CKT NO	A	C	CKT NO	BRKR SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#8	LIGHTING - UNDER ROADWAY	1.8	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#8	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.0	METER PAY STATIONS (NEW LOAD)	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	20/1		SPARE	
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/1		SPARE	

CONN LTG 10.2 KVA; CONN EQUIP KVA; CONN HVAC KVA; AFTER LOAD KVA; CONN RCPT 2.0 KVA; TOTAL LOAD 12.2 KVA; 34 AMPS

EXISTING LIGHTING LOAD ON PANEL 'T' IS 10.2 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT LOAD IS 1.0 KVA
TOTAL LOAD 13.8 KVA
(PANEL AND FEEDER ARE RATED FOR 100A)
ALL LOADS ARE EXISTING UNLESS NOTED OTHERWISE.



1 145 - LA BRANCH ST. & CRAWFORD ST.(SITE 7)
SCALE: 1/16" = 1'-0"

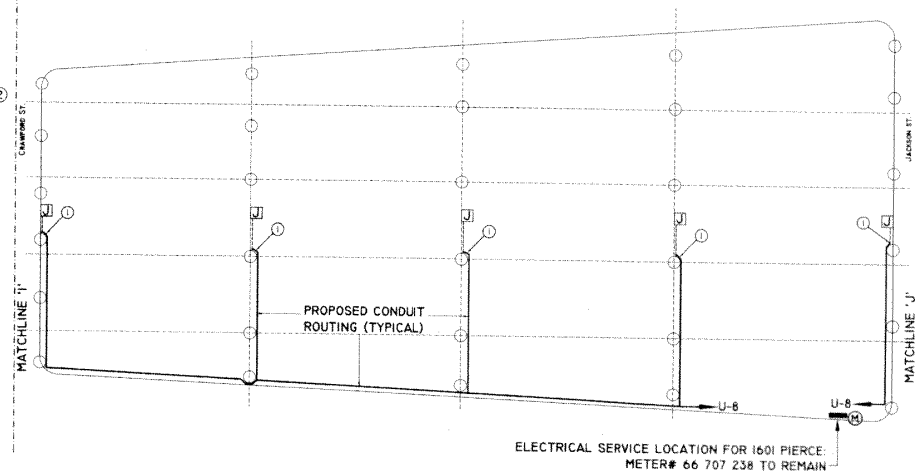
EXISTING

PANEL: U (SITE 8) MTG: ☒ SURFACE ☐ FLUSH SIZE: ☒ NEUTRAL ☒ SYS GND ☐ ISO GND OPT: ☐ INT TVSS ☐ FEED THRU DETAIL: SYM 100 AMP BUS 1 Ø 3 WIRE; CKT 32 MAT AMP MLO 70 AIC; 100 AMP MCB 240/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD KVA	BRKR SIZE	CKT NO	A	C	CKT NO	BRKR SIZE	LOAD KVA	LOAD DESCRIPTION	WIRE SIZE
3#10	LIGHTING - UNDER ROADWAY	1.5	20/1	1			2	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	3			4	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	1.2	20/1	5			6	20/1	1.2	LIGHTING - UNDER ROADWAY	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	7			8	20/1	1.0	METER PAY STATIONS (NEW LOAD)	3#10
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	9			10	20/1		SPARE	
3#10	LIGHTING - UNDER ROADWAY	0.9	20/1	11			12	20/1		SPARE	

CONN LTG 10.2 KVA; CONN EQUIP KVA; CONN HVAC KVA; AFTER LOAD KVA; CONN RCPT 2.0 KVA; TOTAL LOAD 12.2 KVA; 35 AMPS

EXISTING LIGHTING LOAD ON PANEL 'U' IS 10.2 X 1.25= 12.8 KVA
NEW (ADDED) METER EQUIPMENT LOAD IS 1.0 KVA
TOTAL LOAD 13.8 KVA
(PANEL AND FEEDER ARE RATED FOR 100A)
ALL LOADS ARE EXISTING UNLESS NOTED OTHERWISE.



2 145 - CRAWFORD ST. & JACKSON ST.(SITE 8)
SCALE: 1/16" = 1'-0"

ISSUE LOG

NO.	DATE	DESCRIPTION
1	6/3/08	CLIENT REVISIONS

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 - Houston, Texas 77027
713-622-9264 - Fax 713-622-9267 - www.claunchmiller.com

SEAL(S):

RAVIN TAZEKDZADEH
68923
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS
7/14/08

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
8117 RICHMOND AVENUE, SUITE 100
HOUSTON, TEXAS 77063
(713) 622-9120 PH (713) 622-8557 FAX
WWW.IAHOUSTON.COM

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777

PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS, CALL THE LONE STAR NOTIFICATION 713-223-4087.

Date
Certification: Energy/Gas Facilities
(Approval only of existing underground facilities, unless otherwise noted. Valid for time of review only.)

Date
SOC - Approved for underground conduit facilities only
Signature valid for one year

Date
Certification: Energy/Gas Facilities
(New service lines are not shown)

SHEET TITLE:
E-1.40

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
PARKS & RECREATION
PROGRAMS

FILE NO: FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ:
VERT:
SHEET No: 28 OF 29
CITY DWG. NO.: REVISED JAN. 2007

ELECTRICAL SYMBOLS LEGEND

NOTE: NOT ALL SYMBOLS MAY BE USED ON THE DRAWINGS.

SYMBOL	DESCRIPTION
J (boxed)	ELECTRICAL JUNCTION BOX.
(solid bar)	EXISTING ELECTRICAL PANEL
M (circled)	ELECTRICAL METER
(arrow)	HOMERUN TO DESIGNATED SOURCE

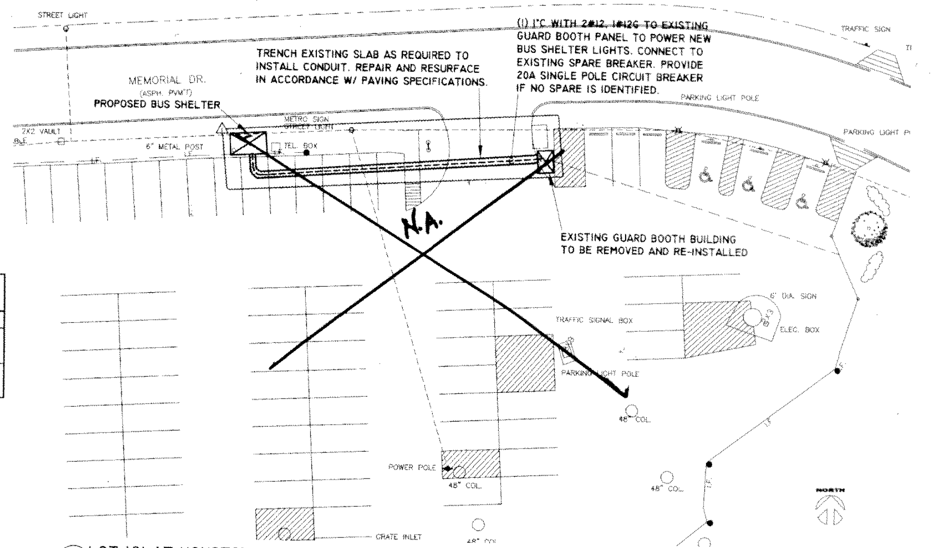
ELECTRICAL KEY NOTES

KEY NOTES APPLY TO ALL DRAWINGS

KEY NOTE	DESCRIPTION
1	REFER TO DETAIL 1 SHEET E-1.10.
2	ALL LIGHTING LOADS SHOWN ARE EXISTING. USE SPARE BREAKERS INDICATED TO SERVE NEW METERING & BOOTH EQUIPMENT

LUMINAIRE SCHEDULE

DESCRIPTION	LAMPS	VOLTS	WATTS	MOUNTING	MANUFACTURERS
EXISTING PARKING STRUCTURE LIGHT FIXTURE, BRACKET MOUNTED, DIE-CAST METAL HALIDE	1 250W MH	120	250	COLUMN BRACKET	LITHONIA CAT# ASW2 250MSR2120 UNAT
6" X 24" WHITE FLUORESCENT FIXTURE WITH WHITE ACRYLIC LENS	2 17W T8	120	48	SURFACE MOUNT	LUMAX LIGHTING WF-2-17-24-EO-1-W



1 ~~LOT 'C' AT HOUSTON AVE. & MEMORIAL DR.~~ NOT IN CONTRACT

SCALE: 1/16" = 1'-0"

ELECTRICAL SPECIFICATIONS

1. SCOPE: SCOPE OF WORK INCLUDES INSTALLATION OF ELECTRICAL SERVICES FOR NEW PARKING METERS. CONTRACTOR FOR THIS DIVISION SHALL PROVIDE AND INSTALL A COMPLETE AND FUNCTIONING ELECTRICAL SYSTEM CONSISTING OF REQUIRED ELECTRICAL COMPONENTS BUT NOT NECESSARILY LIMITED TO CONDUITS, RACEWAYS, CONDUIT BODIES, WIRES, CABLES, FITTINGS, TESTING OF INSTALLED SYSTEMS, EXCAVATION AND COORDINATION WITH OTHER TRADES.

2. SITE VISIT AND FAMILIARIZATION: CONTRACTORS PROPOSING TO UNDERTAKE WORK UNDER THIS DIVISION SHALL VISIT THE SITE OF THE WORK, AND FULLY INFORM THEMSELVES OF ALL CONDITIONS THAT AFFECT THE WORK, OR COST THEREOF. CONTRACTOR SHALL EXAMINE THE DRAWINGS AND SPECIFICATIONS AS RELATED TO THE SITE CONDITIONS. CONTRACTOR SHALL VERIFY THE CONDITION OF THE EXISTING ELECTRICAL DISTRIBUTION SYSTEM AND COMPARE WITH WHAT IS SHOWN ON THE CONSTRUCTION DOCUMENT. ANY DISCREPANCY SHALL BE REPORTED TO THE ENGINEER.

3. NOTICE: CONSIDERATION WILL NOT BE GRANTED FOR ANY ALLEGED MISUNDERSTANDING OF THE AMOUNT OF WORK TO BE PERFORMED. TENDER OF A PROPOSAL SHALL CONVEY FULL AGREEMENT TO ALL ITEMS AND CONDITIONS SPECIFIED, INDICATED ON THE DRAWINGS, AND/OR REQUIRED BY NATURE OF THE SITE.

4. DISCREPANCIES: SHOULD CONTRACTOR FIND DISCREPANCIES OR OMISSIONS IN THE CONTRACT DOCUMENTS, OR BE IN DOUBT AS TO THE INTENT THEREOF, HE SHALL IMMEDIATELY OBTAIN CLARIFICATION FROM THE ARCHITECT BEFORE SUBMITTING PROPOSAL FOR WORK IN THIS DIVISION.

5. TIMELY PLACING OF MATERIALS AND EQUIPMENT: ALL ELECTRICAL APPARATUS SHALL BE INSTALLED AT THE PROPER TIME DURING PROGRESS OF CONSTRUCTION. COORDINATE WORK OPERATIONS WITH OTHER CRAFTS.

6. SPACE REQUIREMENTS: CONTRACTOR FOR WORK UNDER THIS DIVISION SHALL BE FULLY RESPONSIBLE FOR DETERMINING IN ADVANCE OF PURCHASE THAT EQUIPMENT AND MATERIALS PROPOSED FOR INSTALLATION SHALL FIT INTO THE CONFINES INDICATED.

7. MANUFACTURER'S LITERATURE: DELIVER ALL PRINTED TAGS, INSTRUCTIONS, CERTIFIED DRAWINGS, PARTS LISTS, CERTIFICATES, ETC., SUPPLIED WITH EQUIPMENT ITEMS, TO THE OWNER REPRESENTATIVE.

8. CODES, PERMITS, AND FEES: WORK UNDER THIS DIVISION SHALL BE CONSTRUCTED IN STRICT CONFORMANCE WITH PERTINENT PROVISIONS OF CITY AND STATE BUILDING CODES.
   A. ALL WORK SHALL COMPLY WITH THE LATEST EDITION OF NATIONAL ELECTRICAL CODE (NEC).
   B. OBTAIN ALL REQUIRED PERMITS. PAY ALL LEGAL FEES FOR PERMITS AND INSPECTIONS BY AUTHORITIES HAVING JURISDICTION.
   C. ALL WORK SHALL COMPLY WITH REQUIREMENTS OF CITY OF HOUSTON.

9. CUTTING AND PATCHING:
   A. CONTRACTOR FOR THIS DIVISION SHALL LAYOUT TO DIMENSIONS AND LOCATIONS AND CUT AND PATCH ALL OPENINGS ON SURFACES TO BE FRAMED OR CUT.
   B. SHOULD CONTRACTOR FOR THIS DIVISION FAIL TO ADHERE WITH THIS REQUIREMENT, AS WORK PROGRESSES, ANY OPENINGS SHALL BE CUT AND PATCHED BY GENERAL CONTRACTOR AT THE EXPENSE OF THIS CONTRACTOR.

10. PROTECTION OF APPARATUS: TAKE ALL PRECAUTIONS NECESSARY FOR PROPER PROTECTION OF NEW AND EXISTING EQUIPMENT, APPARATUS, AND MATERIALS FROM DAMAGE. FAILURE TO DO SO WILL BE CAUSE FOR REJECTION OF ANY ITEM COMING UNDER QUESTION.

11. WORK IN OTHER DIVISIONS: SEE CIVIL DRAWINGS FOR RELATED WORK.

12. MATERIALS AND WORKMANSHIP: ALL MATERIALS AND EQUIPMENT SHALL BE NEW, OF BEST GRADE OF STANDARD MANUFACTURE AND APPROVED BY UL, AND BE SO LABELED. FOR WIRE AND CABLE, MARKED AS REQUIRED BY ART. 310, NEC, AND INSTALLED BY SKILLED ELECTRICIANS, WORKING UNDER THE DIRECT SUPERVISION OF COMPETENT AND EXPERIENCED FOREMAN AND/OR SUPERINTENDENT. PRODUCTS SHALL BE INSTALLED IN A THOROUGH WORKMANLIKE MANNER, PRESENTING A NEAT, CLEAN-CUT APPEARANCE WHEN COMPLETED. ANY PART OR PARTS NOT MEETING THIS REQUIREMENT SHALL BE REPLACED OR REBUILT WITHOUT EXTRA EXPENSE TO OWNER.

13. WIRING METHODS: THE DRAWINGS ARE DIAGRAMMATIC AND ARE INTENDED TO SHOW THE GENERAL LOCATIONS OF EQUIPMENT AND ARRANGEMENT OF CIRCUITS ONLY. EXACT LOCATIONS SHALL BE DETERMINED BY ACTUAL MEASUREMENT AT THE SITE. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ALL RISES, DROPS, OFFSETS, ETC. NECESSARY TO AVOID CONFLICT WITH EXISTING UTILITY LINES AND SIMILAR ITEMS. WHEN INSTALLING ELECTRICAL CONDUITS, INSTALL EXPOSED CONDUIT AS SHOWN OR NOTED, PARALLEL TO HORIZONTAL AND VERTICAL LINES OF SITE. MAKE BENDS WITH 90 DEGREE TURN MAXIMUM, OR WITH APPROVED FITTINGS.

14. CONDUIT: FURNISH A COMPLETE RACEWAY SYSTEM FOR BUT NOT LIMITED TO FEEDER, BRANCH CIRCUITS AND WIRING. RACEWAY SYSTEMS INSTALLED SHALL BE APPROVED FOR OUTDOOR.
   A. USE LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS WHERE THE EQUIPMENT IS SUBJECT TO MOVEMENT, OR LOCATED OUTDOORS.
   B. USE OF EMT IS NOT PERMITTED. USE PVC COVERED RIGID GALVANIZED CONDUIT FOR ALL EXPOSED OUTDOOR LOCATIONS.
   C. WHERE ENTERING THE PANELS, PULL BOXES, J-BOXES, OR OUTLET BOXES, BE SECURED IN PLACE WITH LOCK-NUTS INSIDE AND OUTSIDE, AND INSULATED BUSHING INSIDE.
   D. BENDS AND OFFSETS MADE WITH APPROVED TOOLS ONLY. BENDS OR OFFSETS IN WHICH THE PIPE IS CRUSHED OR DEFORMED SHALL NOT BE INSTALLED.
   E. WHERE NOT EMBEDDED IN CONCRETE OR MASONRY, RACEWAY SHALL BE FIRMLY SECURED BY APPROVED CLAMPS, STRAPS, OR HANGERS.
   F. USE COMPRESSION TYPE FITTINGS. SET SCREW FITTINGS ARE NOT ACCEPTABLE.
   G. USE PVC CONDUIT FOR INSTALLATION UNDER PAVEMENT.

15. OUTLET AND JUNCTION BOXES: FURNISH AND INSTALL ALL JUNCTION BOXES REQUIRED TO FACILITATE INSTALLATION OF VARIOUS CONDUIT SYSTEMS. BOXES SHALL BE APPROVED FOR INTENDED USE AND APPLICATIONS.

16. WIRE AND CABLE: ALL WIRE AND CABLE SHALL:
   A. BE OF SOFT DRAWN, ANNEALED, COPPER HAVING A CONDUCTIVITY OF NOT LESS THAN 98 % OF THAT OF PURE COPPER; EACH WIRE CONTINUOUS WITHOUT WELD, SPLICE OR JOINT THROUGHOUT ITS LENGTH; UNIFORM IN CROSS SECTION AND FREE FROM FLAWS, SCALES, AND OTHER IMPERFECTIONS.
   B. UNLESS OTHERWISE SPECIFIED OR NOTES, WIRES SHALL BE TYPE THHN, THWN, AS MANUFACTURED BY TRIANGLE, GENERAL ELECTRIC, OKONITE, OR ANACONDA.
   C. BE STRANDED, IN No 8 AND LARGER.
   D. NOT BE PULLED INTO A CONDUIT UNTIL ALL WORK WHICH MAY CAUSE INJURY IS COMPLETE. WHERE TWO OR MORE CIRCUITS RUN TO A SINGLE OUTLET BOX, TAG EACH CIRCUIT.
   E. HAVE ALL STRANDED CONDUCTORS FURNISHED WITH COPPER CONNECTING LUGS, SIZED FOR THE FULL DIAMETER OF THE BARE CONDUCTORS. MAINS AND FEEDERS SHALL BE RUN THEIR ENTIRE LENGTH IN CONTINUOUS PIECES WITHOUT JOINTS OR SPLICES.

17. IDENTIFICATION OF CONDUCTORS AND PANELBOARD ELEMENTS:
   A. EACH AND EVERY FEEDER CONDUCTOR SHALL BE IDENTIFIED AT EACH OUTLET POINT WHERE SUCH CONDUCTOR TERMINATES. FEEDER BUNDLES PASSING THROUGH A JUNCTION OR SUPPORT BOX SHALL ALSO BE IDENTIFIED WITHIN SUCH ENCLOSURE, BUT MAY BE IDENTIFIED IN SUCH LOCATIONS AS A GROUP.
   B. IDENTIFY BY USE OF PERMANENT TYPE BANDS, BRADY, OR T AND B. A DEFINITE NUMBER AND/OR LETTER CODE SHALL BE EMPLOYED AND BE UNIFORM THROUGHOUT EACH CONDUCTOR.
   C. IDENTIFY EACH SWITCH, INCLUDING MAIN DISCONNECT WITH WHITE-ON-BLACK NAMEPLATE, EACH HAVING 1/4" HIGH LETTERS. NEATLY AND SECURELY ADHERE NAMEPLATES TO THE UNIT.

18. GROUNDING: ALL CONDUIT WORK, MOTOR, STARTERS, AND OTHER ELECTRICAL EQUIPMENT WIRED AND CONNECTED BY THIS CONTRACTOR SHALL BE EFFECTIVELY AND PERMANENTLY GROUNDED IN FULL ACCORDANCE WITH NEC 250.

19. OTHER MATERIALS: FURNISH AND INSTALL ALL OTHER MATERIALS SUCH AS HARDWARE, TAPE, CLAMPS, CONNECTORS, FITTINGS, SUPPORTS, AND ALL OTHER APPURTENANCES REQUIRED TO COMPLETE THE WORK TO THE FULL INTENT OF THE CONTRACT. TERMINAL LUGS SHALL BE FURNISHED BY ELECTRICAL CONTRACTOR

ISSUE LOG

NO.	DATE	DESCRIPTION
△	6/3/08	CLIENT REVISIONS

CONSULTANT(S):

CLAUNCH & MILLER, INC.
Engineering Consultants
4635 Southwest Freeway, Suite 1000 • Houston, Texas 77027
713-622-9264 • Fax 713-622-9265 • www.claunchmiller.com

SEAL(S): RAHIM TAZEHZADEH 88923 LICENSED PROFESSIONAL ENGINEER 6/4/08

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
5117 RICHMOND AVENUE, SUITE 100
HOUSTON, TEXAS 77057
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

PROJECT NAME:
HOUSTON-PIERCE ELEVATED AND LOT "C" PARKING LOT IMPROVEMENTS

CITY OF HOUSTON
GENERAL SERVICES DEPARTMENT

REVIEWED:
PROGRAM MANAGER — SPONSORING DEPARTMENT
PROJECT MANAGER

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT AT 713-207-7777.
PRIVATE UTILITY LINES SHOWN
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LONE STAR NOTIFICATION 713-223-4567.
CenterPoint Energy/Electric Facilities — Date: 1-19-10
SBC — Date: 7/8/08
CenterPoint Energy/Gas Facilities — Date: 1-19-10

SHEET TITLE:
E-1.50

NOTE: CITY SIGNATURES VALID FOR ONE YEAR ONLY AFTER DATE OF SIGNATURES
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

FILE NO: — FOR CITY OF HOUSTON USE ONLY
DRAWING SCALE
HORZ.:
VERT.:
SHEET No: 29 of 29
CITY DWG. NO.: — REVISED JAN 2008

SECTION C

A PDF version of this 2009 Engineering Wage Scale can be viewed on the following web link
https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23579

GENERAL TERMS AND CONDITIONS

A PDF version of the General Terms and Conditions can be viewed on the following web link
https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23579

Document 00800
SUPPLEMENTARY CONDITIONS

The following Paragraphs amend and supplement the 2005 edition of General Conditions. Unaltered portions of General Conditions remain in effect.

ARTICLE 3 - THE CONTRACTOR

3.5 *LABOR*: *Insert the following Paragraph 3.5.3.1.1.*

3.5.3.1.1 Contractor shall make good faith efforts to comply with the City ordinances regarding Minority and Women Business Enterprises (MWBE) and Persons with Disabilities Business Enterprises (PDBE) participation goals which are as follows:

.1 the MWBE goal is 0 percent, and

.2 the PDBE goal is 0 percent.

3.28 ***CONTRACTOR DEBT***

3.28.1 IF CONTRACTOR, AT ANY TIME DURING THE TERM OF THIS AGREEMENT, INCURS A DEBT, AS THE WORD IS DEFINED IN SECTION 15-122 OF THE HOUSTON CITY CODE OF ORDINANCES, IT SHALL IMMEDIATELY NOTIFY CITY CONTROLLER IN WRITING. IF CITY CONTROLLER BECOMES AWARE THAT CONTRACTOR HAS INCURRED A DEBT, IT SHALL IMMEDIATELY NOTIFY CONTRACTOR IN WRITING. IF CONTRACTOR DOES NOT PAY THE DEBT WITHIN 30 DAYS OF EITHER SUCH NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS IN AN AMOUNT EQUAL TO THE DEBT FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOURSE THEREFORE.

ARTICLE 8 - TIME

8.1 *PROGRESS AND COMPLETION: Delete Paragraph 8.1.6. and replace with the following 8.1.6.*

8.1.6.1 Contractor shall credit the City by Change Order for inspection services for overtime work or work performed on Sundays or Legal Holidays. The amount Contractor credits the City will be **$50.00 per hour** per inspector for inspection services.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 *UNIT PRICE WORK*: *Delete Section 9.1 in its entirety and insert the following Section 9.1.*

9.1 References to Unit Prices in individual Specification sections are not applicable to the Contract. Include payment for portions of the Work required by these sections in the Stipulated Price for the Contract.

9.12 ***LIQUIDATED DAMAGES***: *Insert the following Paragraph 9.12.1.1.*

9.12.1.1 The amount of liquidated damages provided in General Conditions Paragraph 9.12.1payable by Contractor or Surety for each and every day of delay beyond Contract Time, are ***$1,200.00 per day.***

ARTICLE 11 - INSURANCE AND BONDS

11.2 *INSURANCE TO BE PROVIDED BY CONTRACTOR: Delete Paragraph 11.2.8. and replace with the following 11.2.8.*

11.2.1.4 Contractor shall provide Owners and Contractor's Protective Liability Insurance only if the contractor's bid price is equal to or greater than $100,000.00.

11.2.8 *Endorsement of Primary Insurance:* Each policy except Workers' Compensation Insurance must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising under the Contract.

CITY OF HOUSTON -- BIDDER'S BOND

(Must be in an amount at least 10% of the bid. If the bid is upon alternates this bond must be for at least 10% of the highest amount for which the bidder offers to do any or all the work bid upon.)

THE STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF HARRIS §

THAT WE, _____ as principal and the other subscriber hereto as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation in the sum of $_____ Dollars ($_____).

The condition of this obligation is that: ---

WHEREAS, the said principal is submitting to the City of Houston his or its bid for the doing for the City of Houston of certain work and construction of which the following is a brief description, to-wit: ---

Bid No. C23579
Pierce Elevated Parking Lot Improvements / Pierce Street (Blocks 700-1600), (493Q)

In accordance with the plans and specifications for such work upon which such bid is made, to which plans and specifications reference is made for a more full description of the work and construction referred to.

NOW, THEREFORE, if the said bidder is awarded the contract for such work, the said bidder will, within the time provided in the specifications, enter into a contract with the City therefore upon the form and to the purpose and intent provided in the specifications, will furnish insurance as required in the specifications and will furnish a good and sufficient construction surety bond executed by said bidder and one corporate surety organized under the laws of the State of Texas or authorized to do business in the State of Texas and having a fully paid up capital stock of not less than $100,000.00 and duly licensed and qualified by the Board of Insurance Commissioners of the State of Texas, which bond shall be for an amount equal to 100 percent of the contract price and shall be conditioned in accordance with the requirements stated in the specifications upon which such bid is being submitted.

In the event said bidder is unable or fails to execute said contract for the work proposed to be done, is unable or fails to furnish insurance as specified or is unable or fails to furnish said construction bond in the amount and condition as aforesaid, the undersigned principal and surety shall be liable to said City of Houston for the full amount of this obligation which is here and now agreed upon and admitted as the amount of the damages which will be suffered by the City of Houston on account of the failure of such bidder to so comply with the terms of this bid.

Executed this _____day of _____, A.D. 2010.

PRINCIPAL

By_____

By_____

_____
Surety

Document 00612
ONE-YEAR MAINTENANCE BOND

THAT WE, _____, as Principal, hereinafter called Contractor, and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of $_____, for the payment of which sum well and truly to be made to the City of Houston and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City of Houston for _____
_____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and correct work not in accordance with the Contract documents discovered within the established one-year period, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

_____
Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

_____
Full Name of Surety

_____
Address of Surety for Notice

_____

_____
Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

_____
Legal Assistant

_____
Date

Document 00610

PERFORMANCE BOND

THAT WE, _____, as Principal, (the "Contractor"), and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston (the "City"), a municipal corporation, in the penal sum of $_____ for the payment of which sum, well and truly to be made to the City, its successors and assigns, Contractor and Surety do bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City for _____ _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall faithfully and strictly perform the Contract in all its terms, provisions, and stipulations in accordance with its true meaning and effect, and in accordance with the Contract documents referred to therein and shall comply strictly with each and every provision of the Contract and with this Bond, then this obligation shall become null and void and shall have no further force and effect; otherwise the same is to remain in full force and effect. Should the Contractor fail to faithfully and strictly perform the Contract in all its terms, including but not limited to the indemnifications thereunder, the Surety shall be liable for all damages, losses, expenses and liabilities that the City may suffer in consequence thereof, as more fully set forth herein.

It is further understood and agreed that the Surety does hereby relieve the City or its representatives from the exercise of any diligence whatever in securing compliance on the part of the Contractor with the terms of the Contract, and the Surety agrees that it shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the Contractor in all matters pertaining to the Contract. The Surety understands and agrees that the provision in the Contract that the City will retain certain amounts due the Contractor until the expiration of 30 days from the acceptance of the Work is intended for the City's benefit, and the City will have the right to pay or withhold such retained amounts or any other amount owing under the Contract without changing or affecting the liability of the Surety hereon in any degree.

It is further expressly agreed by Surety that the City or its representatives are at liberty at any time, without notice to the Surety, to make any change in the Contract documents and in the Work to be done thereunder, as provided in the Contract, and in the terms and conditions thereof, or to make any change in, addition to, or deduction from the Work to be done thereunder; and that such changes, if made, shall not in any way vitiate the obligation in this Bond and undertaking or release the Surety therefrom.

It is further expressly agreed and understood that the Contractor and Surety will fully indemnify and save harmless the City from any liability, loss, cost, expense, or damage arising out of Contractor's performance of the Contract.

If the City gives Surety notice of Contractor's default, Surety shall, within 45 days, take one of the following actions:

1. Arrange for Contractor, with consent of the City, to perform and complete the Contract; or

2. Take over and assume completion of the Contract itself, through its agents or through independent contractors, and become entitled to the payment of the balance of the Contract Price.

If the Surety fails to take either of the actions set out above, it shall be deemed to have waived its right to perform and complete the Contract and receive payment of the balance of the Contract Price and the City shall be entitled to enforce any remedies available at law, including but not limited to completing the Contract itself and recovering any cost in excess of the Original Contract Price from the Surety.

This Bond and all obligations created hereunder shall be performable in Harris County, Texas. This Bond is given in compliance with the provisions of Chapter 2253, Texas Government Code, as amended, which is incorporated herein by this reference.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

EXECUTED in multiple originals this_____day of_____, 20_____.

ATTEST/SEAL: (if a corporation)
WITNESS: (if not corporation)

_____
(Name of Principal)

_____
(Address of Principal)

By: _____
Name:
Title:
Date:

By: _____
Name:
Title:
Date:

ATTEST/SEAL
SURETY WITNESS:

_____
(Name of Surety)

_____
(Address of Surety)

By: _____
Name:
Title:
Date:

By: _____
Name:
Title:
Date:

REVIEWED:

This Bond has been reviewed as to form by the undersigned Paralegal and has been found to meet established Legal Department criteria.

_____
Date

_____
Paralegal

Document 00611

STATUTORY PAYMENT BOND

THAT WE, _____, as Principal, hereinafter called Contractor and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of Houston, a municipal corporation, in the sum of $_____ for the payment of which sum, well and truly to be made to the City of Houston, and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a contract in writing with the City of Houston for _____ _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein;

NOW, THEREFORE, if the said Contractor shall pay all claimants supplying labor and materials to him or a Subcontractor in the prosecution of the Work provided for in the Contract, then, this obligation shall be void; otherwise the same is to remain in full force and effect;

PROVIDED HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253, Texas Government Code, as amended, and all liabilities on this Bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

_____
Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

_____
Full Name of Surety

_____
Address of Surety for Notice

_____

_____
Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

_____
Legal Assistant

_____
Date