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SECTION 01040
PROJECT COORDINATION

1. GENERAL

1.1 SUMMARY

- A. This section specifies administrative and supervisory requirements necessary for project coordination including but not necessarily limited to:
 - 1. Coordination.
 - 2. Administrative and supervisory personnel.
 - 3. General installation provisions.
- B. Progress meetings, coordination meetings, and pre-installation conferences are included in Section 01200, Project Meetings.
- C. Requirements for the Contractors construction schedule are included in Section 01300, Submittals.

1.2 COORDINATION

- A. Coordination: Coordinate construction activities included under various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections of the specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service, and, repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Prepare memoranda for distribution to each involved party outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.

4. Progress meetings.
5. Project closeout activities.

1.3 SUBMITTALS

Within 10 days of the Notice to Proceed, the Contractor will submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the site; provide a proposed organizational chart identifying individuals, their duties and responsibilities; and list the proposed staffs addresses and telephone numbers.

1.4 GENERAL INSTALLATION PROVISIONS

- A. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations if those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.
- B. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- C. Recheck measurements and dimensions before starting installation procedure.
- D. Install each component during weather conditions and at the point in project sequence that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- E. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

1.5 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Limiting Exposures: Supervise construction activities to ensure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 1. Excessive static or dynamic loading.
 2. Excessive internal or external pressures.
 3. Heavy traffic.
 4. Vibration from adjacent activity.
 5. Erosion.
 6. Damage by contact with construction equipment.

2. PRODUCTS

(Not Used)

3. EXECUTION

(Not Used)

4. MEASUREMENT & PAYMENT

(Not Used)

END OF SECTION

SECTION 01090
DEFINITIONS AND STANDARDS

1. GENERAL

1.1 SUMMARY

- A. This section specifies administrative requirements for compliance with governing regulations, codes, and standards.
- B. Requirements include obtaining permits, licenses, inspections, releases, and similar documentation as well as payments, statements, and similar requirements associated with regulations, codes, and standards.

1.2 DEFINITIONS

- A. General: Definitions contained in this article are not necessarily complete but are general to the extent that they are not defined more explicitly elsewhere in the Contract Documents.
- B. Indicated: Indicated refers to graphic representations, notes, or schedules on the drawings; other paragraphs or schedules in the specifications; and similar requirements in the Contract Documents. Where terms such as shown, noted, and specified are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Engineer, requested by the Engineer, interpreted to extend the Engineers responsibility into the Contractors area of construction supervision.
- D. Approved: The term approved, where used in conjunction with the Engineers action on the Contractors submittals, applications, and requests, is limited to the responsibilities and duties of the Engineer stated in the General and Special Conditions. Such approval will not release the Contractor from responsibility to fulfill Contract Document requirements unless otherwise provided in the Contract Documents.
- E. Regulations: The term regulations include laws, statutes, ordinances, and lawful orders issued by authorities having jurisdiction as well as rules, conventions, and agreements within the construction industry that control performance of the work, whether they are lawfully imposed by authorities having jurisdiction or not.
- F. Furnish: The term furnish is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term install is used to describe operations at the project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, and finishing, curing, protecting, cleaning, and similar operations.

- H. Provide: The term provide means to furnish and install, complete and ready for the intended use.
- I. Installer: An installer is an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
- J. Project Site: That space made available by the Engineer to the Contractor for performance of the work either exclusively or in conjunction with others performing other construction as part of the project. The overall extent of the project site is shown on the drawings.
- K. Testing Laboratories: A testing laboratory is an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report on and, if required, interpret results of those inspections or tests.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards:
 - 1. Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.
 - 2. Referenced standards take precedence over standards that are not referenced but recognized in the construction industry as standard practice.
- B. Publication Dates: Where compliance with an industry standard is required, comply with the standard in effect as of the date of the Contract Documents.
- C. Conflicting Requirements:
 - 1. Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced unless the Contract Documents indicate otherwise. Refer requirements that are different but apparently equal and uncertainties as to which level is more stringent to the Engineer for a decision before proceeding.
 - 2. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified will be the minimum to be provided or performed. The actual installation may comply exactly, within specified tolerances, with the minimum quantity or quality specified, or it may exceed that minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum values as noted or appropriate for the context of the requirements. Refer instances of uncertainty to the Engineer for decision before proceeding.

- D. Copies of Standards: Each entity engaged in construction on the project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are listed but not included with the Contract Documents. Also refer to paragraph 1.03-A-1.

- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other Contract Documents they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.

2. PRODUCTS

(Not Used)

3. EXECUTION

(Not Used)

4. MEASUREMENT & PAYMENT

(Not Used)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

1. GENERAL

1.1 SUMMARY

- A. This section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Preconstruction conferences.
 - 2. Pre-installation meetings.
 - 3. Coordination meetings.
 - 4. Progress meetings.

- B. Construction schedules are specified in Section 01300, Submittals.

1.2 PRECONSTRUCTION CONFERENCE

- A. A preconstruction conference and organizational meeting will be scheduled by the Engineer at the project site or other convenient location no later than 10 days after execution of the Agreement and prior to commencement of construction activities. The meeting will be conducted to review responsibilities and personnel assignments with the Engineer and the Contractor.

- B. Attendees: The Engineer, Contractor, and subcontractors will each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule.
 - 2. Critical working sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions.
 - 5. Procedures for processing applications for payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of shop drawings, product data, and samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Office, work, and storage areas.
 - 11. Equipment deliveries and priorities.
 - 12. Safety procedures.
 - 13. First aid.
 - 14. Security.
 - 15. Housekeeping.
 - 16. Working hours.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation meetings may be held prior to beginning installation of critical work items. These items include:
 - 1. Steel sheet pile installation.
 - 2. Concrete repair.
- B. These meetings will be attended by all persons involved in the supervision, inspection, and quality control of this work. Those required to attend are as follows:
 - 1. Engineer.
 - 2. Contractor's project manager and superintendent.
 - 3. Subcontractor's superintendent.
 - 4. Crew foremen.
- C. Agenda will include:
 - 1. Layout, horizontal and vertical control, etc.
 - 2. Equipment and materials required.
 - 3. Specific methods to be used for installation.
 - 4. Review of applicable specifications.

1.4 COORDINATION MEETINGS

- A. The Engineer reserves the right to schedule and conduct coordination meetings at his option.
- B. The Contractor will conduct coordination meetings with his subcontractors; however, the Engineer will be invited to such meetings.
- C. Agenda: Review and solve operational conflicts between subcontractors, suppliers, and/or Owner operations.

1.5 PROGRESS MEETINGS

- A. The Engineer reserves the right to schedule and conduct weekly meetings at his option.
- B. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.
- C. Contractors Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractors construction schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.

D. Review the present and future needs of each entity present including such items as:

1. Interface requirements.
2. Time.
3. Sequences.
4. Site utilization.
5. Hours of work.
6. Hazards and risks.
7. Housekeeping.
8. Quality and work standards.
9. Change orders.
10. Documentation of information for payment requests.

E. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

2. PRODUCTS

(Not Used)

3. EXECUTION

(Not Used)

4. MEASUREMENT & PAYMENT

(Not Used)

END OF SECTION

SECTION 01300
SUBMITTALS

1. GENERAL

1.1 SUMMARY

This section specifies administrative and procedural requirements for submittals required for performance of the work, including:

- A. Contractors partial payment and construction schedule.
- B. Submittal schedule.
- C. Shop drawings.
- D. Product data and mill certificates.

1.2 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchase, testing, delivery, other submittals, and related activities that require sequential activities.
 - 2. Processing:
 - a. Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals (including time for resubmittals).
 - b. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Provide a space approximately 4" x 5" on the label or beside the title block on shop drawings to record the Contractors review and approval markings and the action taken.
 - 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.

- c. Name of Engineer.
- d. Name of Contractor.
- e. Name of subcontractor.
- f. Name of supplier.
- g. Name of manufacturer.
- h. Number and title of appropriate specification section.
- i. Drawing number and detail references as appropriate.

1.3 CONTRACTORS PARTIAL PAYMENT AND CONSTRUCTION SCHEDULE

Schedule: Prepare a fully developed construction schedule, preferably a computer based CPM type, but a Gantt chart as a minimum. Submit within 10 days of issuance of the Notice to Proceed. The schedule will include the following:

- A. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities, including minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.
- B. Prepare the Contractors construction schedule with the schedule of values, list of subcontractors, submittal schedule, progress reports, schedule of anticipated monthly partial payment requests, and all other schedules.
- C. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineers procedures necessary for certification of Substantial Completion.

1.4 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractors construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractors construction schedule.
 - 1. Coordinate submittal schedule with the list of subcontractors, schedule of values, and the list of products as well as the Contractor's construction schedule.
 - 2. Prepare the schedule in chronological order; include all submittals required during construction. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related section number.
 - c. Submittal category.
 - d. Name of subcontractor.
 - e. Description of the part of the work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date for Engineers final release or approval.

- B. Distribution:
 - 1. Following response to initial submittal, print and distribute copies to the Engineer, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
 - 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with each meeting report.

1.5 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis for shop drawings. Standard information prepared without specific reference to the project is not considered shop drawings. Reproductions of the Contract Documents will be immediately rejected for resubmittal.
- B. Shop drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
- C. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit shop drawings on sheets at least 8-1/2" x 11", but no larger than 24" x 36".
- D. Final Submittal: Submit one set of sepias and two blue- or black-line prints; submit six prints where required for maintenance manuals.

1.6 PRODUCT DATA

Collect product data into a single submittal for each element of construction or system. Product data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves. Where product data must be specially prepared because standard printed data is not suitable for use, submit as shop drawings.

- A. Manufacturers printed recommendation.
- B. Compliance with recognized testing agency standards.

- C. Application of testing agency labels and seals.
- D. Notation of dimensions verified by field measurement.
- E. Notation of coordination requirements.
- F. Mill certificates.

1.7 ENGINEERS ACTION

- A. Except for submittals for record, information of similar purposes where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
- B. Compliance with specified characteristics is the Contractors responsibility. Submittal will be rejected for non-compliance of required characteristics.
- C. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked to indicate the action taken.
- D. Submittals not returned within 21 days of receipt by the Engineer will be considered approved as submitted by the Contractor.

2. PRODUCTS

(Not Used)

3. EXECUTION

(Not Used)

4. MEASUREMENT & PAYMENT

(Not Used)

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

1. GENERAL

1.1 SECTION INCLUDES

- A. Closeout Procedures
- B. Final Cleaning
- C. Adjusting

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Owner inspection.
- B. Provide submittals to Owner that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean equipment and fixtures to a sanitary condition.
- C. Clean debris from pull boxes, manholes, and drainage systems.
- D. Clean site; sweep paved areas, remove debris from site areas.
- E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Change Orders and other Modifications to the Contract
 - 5. Reviewed shop drawings, product data, and samples
- B. Store Record Documents separate from documents used for construction.

- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract Drawings.
- F. Submit documents to Owner with claim for final Application for Payment.

END OF SECTION

SECTION 021000
SITE PREPARATION

1. GENERAL

1.1 DESCRIPTION

- A. Work Included: Demolition, clearing and grubbing required for this work includes, but is not necessarily limited to:
1. Felling of trees including removal of stumps, roots and other debris protruding through ground surface.
 2. Removing shrubs, grass, weeds and other vegetation.
 3. Removing improvements or obstructions that interfere with new construction.
 4. Constructing temporary barriers around trees designated to remain.
 5. Disconnecting and removing existing utility lines on the site except those designated to remain.
 6. Removal of all debris.
- B. Related Work Described Elsewhere:
1. Earthwork: Section 02200.
- C. Definitions: The term "Demolition, Clearing and Grubbing", as used herein, includes the removal of all existing objects (except for those designated to remain) down to the existing ground level (below grade if required to execute properly the new work), plus such other work as is described in this Section of the Specifications.

1.2 JOB CONDITIONS

- A. Dust Control:
1. Use necessary means to prevent spread of dust during performance of work.
 2. Moisten surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on site.
- B. Disposal of Waste:
1. On site burning will not be permitted.
 2. Remove waste materials and unsuitable or excess topsoil from site and legally dispose of it.

C. Protection:

1. Protect existing objects designated to remain.
2. In event of damage, repair or replace at no additional cost to Owner.

2. PRODUCTS

NONE

3. EXECUTION

3.1 PREPARATION

A. Site Inspection:

1. Prior to start of work, inspect entire site and all objects designated to be removed or preserved.
2. Locate existing utility lines and determine requirements for disconnecting and capping.
3. Locate existing active utility lines traversing site and determine requirements for protection.

B. Clarification:

1. The drawings do not purport to show all objects existing on site.
2. Verify with architect all objects to be removed or preserved before commencing work.

3.2 CLEARING AND GRUBBING

A. Felling of Trees:

1. Protect roots and branches of trees designated to remain.
2. Remove only trees and shrubs within construction area unless otherwise indicated or directed.
3. Completely remove stumps, roots and other debris protruding through ground surface.
4. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

B. Grubbing:

1. Remove all surface rocks, stumps, roots and other vegetation within limits of construction.
2. Do not leave any roots greater than 3 inches in diameter in the ground.

3.3 STRIPPING TOPSOIL

- A. Strip to whatever depths encountered in such a manner to prevent intermingling with underlying subsoil or other objectionable material.
- B. Remove heavy growths of grass from areas before stripping.
- C. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance from trees to prevent damage to main root system.
- D. Stock pile topsoil where directed.
- E. Construct storage piles to freely drain surface water.
- F. Cover storage piles if required to prevent windblown dust.

END OF SECTION

SECTION 021010
PROJECT SIGNS

1. DESCRIPTION

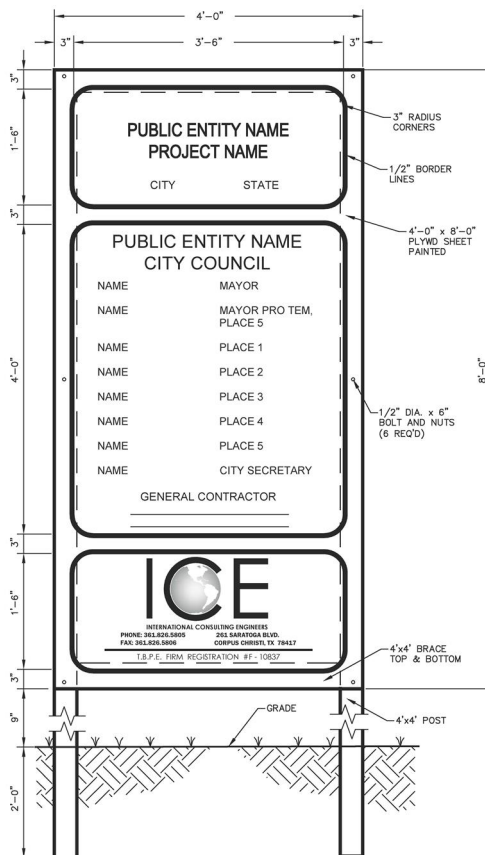
This specification shall govern all work for providing project signs required to complete the project.

2. REQUIREMENTS

The Contractor shall furnish and install project signs as shown below. One (1) project sign is required unless otherwise specified in the contract documents. The signs shall be installed prior to construction and be maintained throughout the project. The locations of the signs shall be subject to approval of the Engineer and shall not obstruct visibility of any motorist.

3. MEASUREMENT AND PAYMENT

Unless indicated otherwise in the Proposal, all work and materials required for providing project signs shall not be measured for pay but will be considered subsidiary to other work as part of a lump sum.



PROJECT SIGN
ONE REQUIRED

END OF SECTION

SECTION 021080
REMOVING OLD STRUCTURES

1. DESCRIPTION

This specification shall provide for the removal and disposal of old structures or portions of old structures, as noted on the plans, and shall include all excavation and backfilling necessary to complete the removal. The work shall be done in accordance with the provisions of these specifications.

2. METHOD OF REMOVAL

Culverts or Sewers. Pipe shall be removed by careful excavation of all dirt on top and the sides in such manner that the pipe will not be damaged. Removal of sewer appurtenances shall be included for removal with the pipe. Those pipes which are deemed unsatisfactory for reuse by the Engineer may be removed in any manner the Contractor may select.

Concrete Structures. Unwanted concrete structures or concrete portions of structures shall be removed to the lines and dimensions shown on the plans, and these materials shall be disposed of as shown on the plans or as directed by the Engineer. Any portion of the existing structure outside of the limits designated for removal which is damaged by the Contractor's operations shall be restored to its original condition at the Contractor's entire expense. Explosives shall not be used in the removal of portions of the existing structure unless approved by the Engineer, in writing.

Portions of the old structure shall be removed to the lines and dimensions shown on the plans, and these materials shall be disposed of as shown on the plans or as directed by the Engineer. Any portion of the existing structure, outside of the limits designated for removal, damaged during the operations of the Contractor, shall be restored to its original condition at the Contractor's entire expense. Explosives shall not be used in the removal of portions of the existing structure unless approved by the Engineer, in writing.

Concrete portions of structures below the permanent ground line, which will not interfere in any manner with the proposed construction, may be left in place, but removal shall be carried at least five (5) feet below the permanent ground line and neatly squared off. Reinforcement shall be cut off close to the concrete. Backfill in one-foot lifts and compact to a minimum of 95% Standard Proctor density.

Steel Structures. Steel structures or steel portions of structures shall be dismantled in sections as determined by the Engineer. The sections shall be stored if the members are to be salvaged and reused. Rivets and bolts connecting steel railing members, steel beams of beam spans and steel stringers of truss spans, shall be removed by butting the heads with a "cold cut" and punching or drilling from the hole, or by such other method that will not injure the members for re-use and will meet the approval of the Engineer. The removal of rivets and bolts from connections of truss members, bracing members, and other similar members in the structure will not be required unless specifically called for on the plans or special provisions, and the Contractor shall have the option of dismantling these members by flame-cutting the members immediately adjacent to the connections. Flame-cutting will not be permitted, however, when the plans or special provisions call for the structure unit to be salvaged in such manner as to permit re-erection. In such case, all members shall be carefully match marked with paint in accordance with diagrams furnished by the Engineer prior to dismantling, and all rivets and bolts shall be removed from the connections in the manner specified in the first portion of this paragraph.

Timber Structures. Timber structures or timber portions of structures to be reused shall be removed in such manner as to damage the timber for further use as little as possible. All bolts and nails shall be

removed from such lumber as deemed salvable by the Engineer.

Unless otherwise specified on the plans, timber piles shall be either pulled or cut off at the point not less than two (2) feet below ground line, with the choice between these two methods resting with the Contractor, unless otherwise specified.

Brick or Stone Structures. Unwanted brick or stone structures or stone portions of structures shall be removed. Portions of such structures below the permanent ground line, which will not in any manner interfere with the proposed construction, may be left in place, but removal shall be carried at least five (5) feet below the permanent ground line and neatly squared off. Backfill in one-foot lifts and compact to a minimum of 95% Standard Proctor density.

Salvage. All material such as pipe, timbers, railings, etc., which the Engineer deems as salvable for reuse, and all salvaged structural steel, shall be delivered to a designated storage area.

Materials, other than structural steel, which are not deemed salvable by the Engineer, shall become the property of the Contractor and shall be removed to suitable disposal sites off of the right-of-way arranged for by the Contractor, or otherwise disposed of in a manner satisfactory to the Engineer.

Where temporary structures are necessary for a detour adjacent to the present structure, the Contractor will be permitted to use the material in the old structure for the detour structure, but he shall dismantle and stack or dispose of the material as required above as soon as the new structure is opened for traffic.

Backfill. All excavations made in connection with this specification and all openings below the natural ground line caused by the removal of old structures or portions thereof shall be backfilled to the level of the original ground line, unless otherwise provided on the plans.

That portion of the backfill which will support any portion of the roadbed or embankment shall be placed in layers of the same depth as those required for placing embankment. Material in each layer shall be wetted uniformly, if required, and shall be compacted to a minimum of 95% Standard Proctor density. In places inaccessible to blading and rolling equipment, mechanical or hand tamps or rammers shall be used to obtain the required compaction.

That portion of the backfill which will not support any portion of the roadbed or embankment shall be placed as directed by the Engineer in such manner and to such state of compaction as will preclude objectionable amount of settlement.

3. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 022000
EARTHWORK

1. GENERAL

1.1 DESCRIPTION

A. Work included but not limited to:

1. Parking Areas
2. Driveways
3. Concrete Walks
4. Concrete Structures

1.2 QUALITY ASSURANCE

A. Codes and References:

1. Comply with pertinent codes and regulations.
2. Comply with referenced portions of Texas Highway Department " Standard Specifications for Construction of Highways, Streets and Bridges" (Latest Edition). Payment items shall not apply.

1.3 PRODUCT HANDLING

A. Protection:

1. Protect subgrade materials before, during, and after installation.
2. Protect work and materials of other trades.

B. Replacement: In event of damage, make repairs and replacements as necessary at no additional cost to Owner.

2. PRODUCTS

2.1 SELECTION OF MATERIALS

A. Where shown on plans, selected materials shall be utilized in the formation of embankment or to improve the roadbed, in which case the work shall be performed in such manner and sequence that suitable materials may be selected, removed separately and deposited in the construction area within limits and at elevations required.

3. EXECUTION

3.1 CONSTRUCTION METHODS

A. Stripping and Excavation:

1. Strip the top 6" in all areas to underly compacted fill, curbs, base or pavement, by removing all humus, vegetation and other unsuitable materials. Remove existing trees, shrubs, fences, curb, gutter, sidewalk, drives, paving and structures within the graded area which interfere with new construction or finished grading.
 2. All suitable excavated materials shall be utilized, insofar as practicable, in constructing the required roadway sections or in uniformly widening embankments, flattening slopes, etc., as directed by the Engineer. Unsuitable roadway excavation and roadway excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor to be disposed of by him outside the limits of the right-of-way at a location suitable to the Engineer. "Unsuitable" material encountered below subgrade elevation in roadway cuts, when declared "Waste" by the Engineer, shall be replaced, as directed by the Engineer, with material from the roadway excavation or with other suitable material.
- B. Subgrade preparation:
1. That area shown on the plans for Parking Area, driveway, or concrete structure construction shall be scarified to a depth not less than 6" and compacted to 95% standard proctor density. Irregularities exceeding 1/2" in 16' shall be corrected. Soft areas found at any time shall be dug out, the material replaced with acceptable and compacted (esp. at utility trenches). The moisture density shall be maintained until the subgrade is covered by the specified material.
 2. That area shown on the plans for channel excavation and excavated slopes shall be finished in conformance with the lines and grades shown on the plans and no point on completed slopes shall vary from the designated slopes by more than 0.5 foot measured at right angles to the slope, unless otherwise specified. The tops of excavated slopes and the end of excavation shall be rounded as shown on the plans.
- C. Curb Backfill and Topsoil (Sidewalks, Parkways, Islands, etc.):
1. Compact earth behind curbs without delay after curb completion. The top 3" (where disturbed by construction or where unsatisfactory material is exposed by excavation) of finished earth grade shall be of loamy top soil of approved type and source where "Top Soil" is called for on the plans. No excessive clods are allowed.
- D. Matching Grades at Right -of-Way Line:
1. Finished grade at the property line shall be as shown on the plans. A reasonable amount of filling on private property may be required by the Engineer where the sidewalk grade is above the property elevation. Use suitable material from the excavation.
- E. Drainage:

1. During construction the roadbed and ditches shall be maintained in such condition as to insure proper drainage at all times and ditches and channels shall be constructed and maintained as to avoid damage to the roadway section. All slopes which, in the judgment of the Engineer, require variation shall be accurately shaped and care shall be taken that no material is loosened below the required slopes. All breakage and slides shall be removed and disposed of as directed.

END OF SECTION

SECTION 022020
EXCAVATION AND BACKFILL FOR UTILITIES AND SEWERS

1. DESCRIPTION

This specification shall govern all excavation for storm or sanitary sewers, sewers structures appurtenances and connections, utility pipe or conduits, and for backfilling to the level of the original ground, all in conformity with the locations, lines, and grades shown on the plans or as established by the Engineer. This specification also governs for the necessary pumping or bailing and drainage, and all sheathing and bracing of trench walls, the furnishing and placing of cement stabilized backfill, and hauling and disposition of surplus materials, and the bridging of trenches and other provisions for traffic or access as provided herein.

2. CONSTRUCTION

2.1 GENERAL

Unless otherwise specified on the plans or permitted by the Engineer, all sewers, pipe, and conduit shall be constructed in open cut trenches with vertical sides. Trenches shall be sheathed and braced as necessary throughout the construction period. Sheathing and bracing shall be the responsibility of the Contractor (Section 022022).

Trenches shall have a maximum width of one foot beyond the horizontal projection of the outside surfaces of the pipe and parallel thereto on each side unless otherwise specified.

The Contractor shall not have more the 200 feet of open trench left behind the trenching operation and no more then 500 feet of ditch behind the ditching machine that is not compacted as required by the plans and specification. No trench or excavation shall remain open after working hours.

For all utility conduit and sewer pipe to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than one foot above the top of pipe or conduit after which excavation for the pipe or conduit shall be made.

If quicksand, muck, or similar unstable material, is encountered at the bottom of the excavation, the following procedure shall be used unless other methods are called for on the plans. If the unstable condition is a result of ground water, it shall be controlled by the Contractor, prior to additional excavation. After stable conditions have been achieved, unstable soil shall be removed or stabilized to a depth of 2 feet below the bottom of pipe for pipes 2 feet or more in height; and to a depth equal to the height of pipe, 6 inch minimum, for pipe less then 2 feet in height. Such excavation shall be carried at least 1 foot beyond the horizontal limits of the structure on all sides. All unstable soil so removed shall be replaced with suitable stable material, placed in uniform layers of suitable depth as directed by the Engineer, and each layer shall be wetted, if necessary, and compacted by mechanical tamping as required to provide a stable foundation for the structure. Soil which is considered to be of sufficient stability to sustain properly the adjacent sections of the roadway embankment will be considered a suitable foundation material for the culvert or sewer. For unstable trench conditions requiring outside forms, seals, sheathing, and bracing, or where ground water is encountered and additional excavation and backfill required shall be done at the contractor's expense.

2.2 SHAPING OF TRENCH BOTTOM

The trench bottom shall be undercut a minimum depth sufficient to accommodate the class of bedding indicated in the plans and specification.

2.3 DEWATERING TRENCH

Pipe or conduit shall not be constructed or laid in a trench in the presence of water. All water shall be removed from the trench sufficiently prior to the pipe or conduit planing operation insure a relatively dry (no standing water), firm bed. The trench shall be maintained in such dewatered condition until the trench has been backfilled to a height at lease one foot above the top of pipe. Removal of water may be accomplished by bailing, pumping, or by a well-points installation as conditions warrant. Removal of well points shall be at rate of 1/3 per 24 hours (every third well-point).

2.4 EXCAVATION IN STREETS

Excavation in streets, together with the maintenance of traffic where specified, and the restoration of the pavement riding surface shall be in accordance with plan detail or as required by other applicable specification.

2.5 REMOVING OLD STRUCTURES

When old masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1-foot below the bottom of the trench. When old inlets or manholes are encountered and no plan provision is made for adjustment or connection to the new sewer, such manholes and inlets shall be removed completely to a depth 1-foot below the bottom of the trench. In each instance, the bottom to the trench shall be restored to grade by backfilling and compacting by the methods provided hereinafter for backfill. Where the trench cuts through storm or sanitary sewers which are known to be abandoned, these sewers shall be cut flush with sides of the trench and blocked with a concrete plug in a manner satisfactory to the Engineer.

2.6 PROTECTION OF UTILITIES

The Contractor shall conduct his work such that a reasonable minimum of disturbance to existing utilities will result. Particular care shall be exercised to avoid the cutting or breakage of water and gas line. Such lines, if broken, shall be restored promptly by the Contractor. When active sanitary sewer lines are cut in the trenching operations, temporary flumes shall be provided across the trench, while open, and the lines shall be restored when the backfilling has progressed to the original bedding lines of the sewer so cut.

The Contractor shall inform utility Owners sufficiently in advance of the Contractor's operations to enable such utility Owners to reroute, provide temporary detours, or to make other adjustments to utility lines in order that the Contractor may proceed with his work with a minimum of delay and concerned in effecting any utility adjustments necessary and shall not hold the Owner liable for any expense due to delay or additional work because of conflicts.

2.7 EXCESS EXCAVATED MATERIAL

All materials from excavation not required for backfilling the trench shall be removed, by the Contractor,

from the job site promptly following the completion of work involved.

2.8 BACKFILL

A. Backfill Procedure Around Pipe

All trenches and excavation shall be backfilled as soon as is practical after the pipes or conduits are properly laid. In addition to the specified pipe bedding material, the backfill around the pipe as applicable, shall be backfilled to the base with cement stabilized sand containing a minimum of 2 sacks of standard Type I Portland cement per cubic yard of sand. The backfill shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench, in layers not to exceed six (6) inches (loose measurement), wetted if required to obtain proper compaction, and thoroughly compacted by mechanical tampers to a density comparable to the adjacent undisturbed soil, so that a thoroughly compacted material shall be in place between the external wall of the pipe and the undisturbed sides of the trench:

B. Backfill Over One Foot Above Pipe

The backfill for that portion of trench over (1) foot above the pipe or conduit shall be selected excavated material free of hard lumps, rock fragments, or other debris, placed in layers not more than 6 inches in depth (loose measurement), wetted if required and thoroughly compacted by use of mechanical tampers to the natural bank density and not less than 95% Std. Proctor. Flooding of backfill is not allowed. Jetting of backfill will be allowed in sandy soils and in soils otherwise approved by the Engineer. Regardless of backfill method, no lift shall exceed one foot and density shall not be less than 95% Std. Proctor. The last four feet of backfill shall be placed in layers of not more than 6 inches and compacted by use of mechanical tampers to the natural back density and not less than 95% Std. Proctor.

A period of not less than twenty-four (24) hours shall lapse between the time of jetting and the placing of the top four (4) feet of backfill.

3. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay but shall be subsidiary to the project.

END OF SECTION

SECTION 022021
CONTROL OF GROUND WATER

1. GENERAL

1.1 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in a stable condition, and controlling ground water conditions for tunnel excavations.

B. Protection of excavations and trenches from surface runoff.

C. Disposing of removed ground water by approved methods.

1.2 REFERENCES

A. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49 kg) Rammer and 12-inch (304.8 mm) Drop.

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

C. Federal Register 40 CFR (Vol. 55, No. 222) Part 122, EPA Administered Permit Programs (NPDES), Para.122.26(b)(14) Storm Water Discharge.

1.3 DEFINITIONS

A. Ground water control includes both dewatering and depressurization of water-bearing soil layers.

1) Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts, and disposing of removed ground water by approved methods. The intent of dewatering is to increase the stability of tunnel excavations and excavated slopes; prevent dislocation of material from slopes or bottoms of excavations; reduce lateral loads on sheeting and bracing; improve excavating and hauling characteristics of excavated material; prevent failure or heaving of the bottom of excavations; and to provide suitable conditions for placement of backfill materials and construction of structures, piping and other installations.

2) Depressurization includes reduction in piezometric pressure within strata not controlled by dewatering alone, as required to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage includes keeping excavations free of surface and seepage water.

C. Surface drainage includes the use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect the Work from any source of surface water.

D. Equipment and instrumentation for monitoring and control of the ground water control system includes piezometers and monitoring wells, and devices, such as flow meters, for observing and recording flow rates.

1.4 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations as needed to identify ground water conditions and to provide parameters for design, installation, and operation of ground water control systems.

B. Design a ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and City Standard Specification Section 022022 - Trench Safety for Excavations, to produce the following results:

- 1) Effectively reduce the hydrostatic pressure affecting:
 - a) Excavations (including utility trenches);
 - b) Tunnel excavation, face stability or seepage into tunnels.
- 2) Develop a substantially dry and stable subgrade for subsequent construction operations.
- 3) Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work.
- 4) Prevent the loss of fines, seepage, boils, quick condition, or softening of the foundation strata.
- 5) Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems which may include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials, such as crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water away from excavations.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures, and any settlement or resultant damage caused by the ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of the system to protect property as required.

H. Provide an adequate number of piezometers installed at the proper locations and depths as

required to provide meaningful observations of the conditions affecting the excavation, adjacent structures, and water wells.

I. Provide environmental monitoring wells installed at the proper locations and depths as required to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into the work area or into the ground water control system.

J. Decommission piezometers and monitoring wells installed during design phase studies and left for Contractors monitoring and use, if applicable.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality (TCEQ) regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Prior to beginning construction activities, file Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the Texas Pollutant Elimination System (TPDES) General Permit No. TXR150000, administered by the Texas Commission on Environmental Quality (TCEQ). The general permit falls under the provisions of Section 402 of the Clean Water Act and Chapter 26 of the Texas Water Code.

D. Prepare submittal form and submit to TCEQ along with application fee.

E. Upon completion of construction, file Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under the TPDES General Permit with the TCEQ.

F. Obtain all necessary permits from agencies with control over the use of ground water and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Because the review and permitting process may be lengthy, take early action to pursue and submit for the required approvals.

G. Monitor ground water discharge for contamination while performing pumping in the vicinity of potentially contaminated sites.

H. Conduct sampling and testing of ground water and receiving waters as outlined in Article 3 below.

2. PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Equipment and materials are at the option of Contractor as necessary to achieve desired results for dewatering.

B. Eductors, well points, or deep wells, where used, shall be furnished, installed and operated by an

experienced contractor regularly engaged in ground water control system design, installation, and operation.

C. All equipment must be in good repair and operating order.

D. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

3. EXECUTION

3.1 GROUND WATER CONTROL

A. Perform a subsurface investigation by borings as necessary to identify water bearing layers, piezometric pressures, and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine the drawdown characteristics of the water bearing layers.

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in a manner compatible with construction methods and site conditions. Monitor effectiveness of the installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the ground water control system design. Notify the City's Construction Inspector in writing of any changes made to accommodate field conditions and changes to the Work. Revise the ground water control system design to reflect field changes.

D. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify that the system lowers ground water piezometric levels at a rate required to maintain a dry excavation resulting in a stable subgrade for prosecution of subsequent operations.

F. Where hydrostatic pressures in confined water bearing layers exist below excavation, depressurize those zones to works. Allowable piezometric elevations shall be defined in the ground water control system design.

G. Remove ground water control installations.

1) Remove pumping system components and piping when ground water control is no longer required.

2) Remove piezometers and monitoring wells when directed by the City Engineer.

3) Grout abandoned well and piezometer holes. Fill piping that is not removed with cementbentonite grout or cement-sand grout.

H. During backfilling, dewatering may be reduced to maintain water level a minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement stabilized sand until at least 48

hour after placement.

I. Provide a uniform diameter for each pipe drain run constructed for dewatering. Remove pipe drain when it has served its purpose. If removal of pipe is impractical, provide grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout when pipe is removed from service.

J. Extent of construction ground water control for structures with a permanent perforated underground drainage system may be reduced, such as for units designed to withstand hydrostatic uplift pressure. Provide a means for draining the affected portion of underground system, including standby equipment. Maintain drainage system during operations and remove it when no longer required.

K. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. In unpaved areas, compact backfill to not less than 95 percent of Standard Proctor maximum dry density in accordance with ASTM D 698. In paved areas (or areas to receive paving), compact backfill to not less than 98 percent of Standard Proctor maximum dry density in accordance with ASTM D 698.

3.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For above ground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between every eductor well or well point and discharge header so that discharge from each installation can be visually monitored.

B. Install sufficient piezometers or monitoring wells to show that all trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for Contractor's selected method of work.

C. Install piezometers or monitoring wells not less than one week in advance of beginning the associated excavation (including trenching).

D. Dewatering may be omitted for portions of underdrains or other excavations, but only where auger borings and piezometers or monitoring wells show that soil is pre-drained by an existing system such that the criteria of the ground water control system design are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change the methods, in the event that the installations according to the ground water control system design do not provide satisfactory results based on the performance criteria defined by the ground water control system design and by these specifications.

3.3 EXCAVATION DRAINAGE

A. Contractor may use excavation drainage methods if necessary to achieve well drained conditions. The excavation drainage may consist of a layer of crushed stone and filter fabric, and sump pumping in combination with sufficient wells for ground water control to maintain stable excavation and backfill conditions.

3.4 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while the ground water control installations or excavation drainage are operating in an area or seepage into tunnel is occurring. Keep system in good condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedule.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make observations, as specified.

D. Remove and grout piezometers inside or outside the excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by the City Engineer.

3.5 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also monitor and record water level and ground water recovery. These records shall be obtained daily until steady conditions are achieved, and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until the Work is completed or piezometers or wells are removed, except when City Engineer determines that more frequent monitoring and recording are required. Comply with Construction Inspector's direction for increased monitoring and recording and take measures as necessary to ensure effective dewatering for intended purpose.

3.6 SAMPLING, TESTING AND DISPOSAL OF GROUND WATER

A. It is the intent that the Contractor discharge groundwater primarily into the existing storm water system in accordance with City Ordinance, Article XVI, Section 55-203, only if the groundwater is uncontaminated and the quality of the ground water is equal to or better than the quality of the receiving stream.

B. The Contractor shall prevent ground water from trench or excavation dewatering operations from discharging directly into the storm water system prior to testing and authorization. Ground water from dewatering operations shall be sampled and tested, and disposed of by approved methods.

C. Laboratory analysis of groundwater and receiving water quality is to be performed by the

Contractor at the Contractor's expense, prior to commencing discharge, and groundwater analysis shall be performed by the Contractor at a minimum of once per week. Contractor shall coordinate with the City Storm Water Department on all laboratory analysis. Laboratory analysis of groundwater shall also be performed at each new area of construction prior to discharge from that location.

D. Sample containers, holding times, preservation methods, and analytical methods, shall either follow the requirements in 40 CFR Part 136 (as amended), or the latest edition of "Standard Methods for the Examination of Water and Wastewater." Any laboratory providing analysis must be accredited or certified by the Texas Commission on Environmental Quality according to Title 30 Texas Administrative Code (30 TAC) Chapters 25 for the matrices, methods, and parameters of analysis, if available, or be exempt according to 30 TAC §25.6.

E. Analysis of the ground water discharge shall show it to be equal to or better than the quality of the first natural body of receiving water. This requires testing of both the receiving water and a sample of the ground water. All parts of this procedure shall be complete prior to any discharge of ground water to the storm water system.

F. Steps to Determine Legitimate Discharge:

1) Identify the First Receiving Water.

a) When the first body of water is a fresh water system (Nueces River or Oso Creek), the analysis typically fails because the local ground water will likely be too high in Total Dissolved Solids (TDS). In the case of a perched aquifer, the ground water may turn out fairly fresh, but local experience shows this to be unlikely.

b) If the receiving water is a marine environment, proceed with Step 2 below to compare the ground water quality to receiving water quality.

2) Compare Ground Water Discharge Quality to Receiving Water Quality. The following table, Ground Water Discharge Limits, indicates that the parameters to compare to the receiving water are Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). If the ground water results are equal to or better than the receiving water, then the discharge may be authorized as long as the discharge does not exceed the other parameters which would indicate hydrocarbon contamination. Note that the receiving water only needs to be tested initially as a baseline and the ground water shall be tested weekly to ensure compliance.

GROUND WATER DISCHARGE LIMITS

Parameter	Ground Water Monitoring Frequency	Receiving Water Monitoring Frequency	Maximum Limitation
Total Dissolved Solids (TDS)	Initial + Weekly	Once Prior to Discharge	< Receiving Water
Total Suspended Solids (TSS)	Initial + Weekly	Once Prior to Discharge	< Receiving Water
Total Petroleum Hydrocarbons	Initial + Weekly		15 mg/L
Total Lead	Initial + Weekly		0.1 mg/L
Benzene	Initial + Weekly		0.005 mg/L
Total BTEX	Initial + Weekly		0.1 mg/L
Polynuclear Aromatic Hydrocarbons	Initial + Monthly		0.01 mg/L

3) Analyze Ground Water for Hydrocarbon Contamination.

All other parameters listed on the Ground Water Discharge Limits table must be analyzed prior to ground water discharge to the storm water system. If no limits are exceeded, ground water discharge to the storm water system may be authorized following notification to the MS4 operator (City of Corpus Christi) and all Pollution Prevention Measures for the project are in place. Analytical results shall be on-site or readily available for review by local, state or federal inspectors. Note that this step is frequently done simultaneously with Step 2 above to shorten analytical processing time.

4) Pollution Prevention Measures.

A storm water pollution prevention plan or pollution control plan shall be developed and implemented prior to any ground water discharges to the storm water system. The plan's objectives are to limit erosion and scour of the storm water system, and minimize Total Suspended Solids (TSS) and other forms of contamination, and prevent any damage to the storm water system. Note that ground water discharges must cease immediately upon the first recognition of contamination, either by sensory or analytical methods. If the discharge of groundwater results in any damages to the storm water system, the responsible party shall remediate any damage to the storm water system and the environment to the satisfaction of the Storm Water Department and/or any State or Federal Regulatory Agency.

5) MS4 Operator Notification.

The MS4 operator shall be notified prior to ground water discharge to the storm water system. Contractor shall contact the designated City MS4 representative to request authorization to discharge ground water to the storm water system.

Notification shall include:

Project Name: Responsible Party: Discharge Location: Receiving Water:
 Estimated Time of Discharge: Linear Project: Yes / No

Pollution Prevention Measures Implemented:

Statement indicating all sampling and testing has been conducted and meets the requirements of a legitimate discharge.

G. Discharges to Wastewater System.

In the event that the groundwater does not equal or exceed the receiving water quality, an alternative disposal option would include pumping to the nearest sanitary sewer system. Discharge to the sanitary sewer system requires a permit from the Wastewater Department. If discharging to temporary holding tanks and trucking to a sanitary sewer or wastewater treatment plant, the costs for these operations shall be negotiated.

Contractor shall contact the Pretreatment Group for City Utility Operations to obtain a Wastewater Discharge Permit Application for authorization to discharge to the wastewater system. Authorization approval will include review of laboratory analysis of the ground water and estimated flow data. Note that groundwater discharges must cease immediately upon the first recognition of contamination, either by sensory or analytical methods. If the discharge of groundwater results in any damages to the wastewater collection system or wastewater overflows, the responsible party shall remediate any damage to the wastewater collection system and the environment to the satisfaction of the Wastewater Department and/or any State or Federal Regulatory Agency.

H. Other groundwater disposal alternatives or solutions may be approved by the Engineer on a case by case basis.

3.7 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through the use of dikes, ditches, curb walls, pipes, sumps or other approved means.

B. Divert surface water into sumps and pump into drainage channels or storm drains, when approved by the City Engineer. Provide settling basins when required by the City Engineer.

C. Storm water that enters the excavation can be pumped out as long as care is taken to minimize solids and mud entering the pump suction and flow is pumped to a location that allows for sheet flow prior to entering a storm water drainage ditch or storm water inlet. An alternative to sheet flow is to pump storm water to an area where ponding occurs naturally without leaving the designated work area or by manmade berm(s) prior to entering the storm water system. Sheet flow and ponding is required to allow solids screening and/or settling prior to entering the storm water system. Storm water or groundwater shall not be discharged to private property.

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, control of ground water will not be measured and paid for separately, but shall be considered subsidiary to other bid items.

END OF SECTION

SECTION 022022
TRENCH SAFETY FOR EXCAVATIONS

1. DESCRIPTION

This specification shall govern all work for providing for worker safety in excavations and trenching operations required to complete the project.

2. REQUIREMENTS

Worker Safety in excavations and trenches shall be provided by the Contractor in accordance with Occupational Safety and Health Administration (OSHA) Standards, 29 CFR Part 1926 Subpart P - Excavations.

It is the sole responsibility of the Contractor, and not the Owner or Engineer, to determine and monitor the specific applicability of a safety system to the field conditions to be encountered on the job site during the project.

The Contractor shall indemnify and hold harmless the Owner and Engineer from all damages and cost that may result from failure of methods or equipment used by the Contractor to provide for worker safety.

Trenches as used herein, shall apply to any excavation into which structures, utilities, or sewers are placed regardless of depth.

Trench Safety Plan as used herein shall apply to all methods and materials used to provide for worker safety in excavation and trenching operations required during the project.

3. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 022040
STREET EXCAVATION

1. DESCRIPTION

This specification shall govern all work for Street Excavation required to complete the project.

2. CONSTRUCTION METHODS

(A) Stripping and Excavation

Strip the top 11 inches in all areas to underlay compacted fill, curbs, base or pavement, by removing all humus, vegetation and other unsuitable materials. Unless otherwise noted, remove existing trees, shrubs, fences, curb, gutter, sidewalk, drives, paving, pipe and structures within the graded area which interfere with new construction of finished grading.

All suitable excavated materials shall be utilized, insofar as practicable, in constructing the required roadway sections or in uniformly widening embankments, flattening slopes, etc., as directed by the Engineer, provided that the material has a plasticity index (P.I.) of 35 or less. Unwanted roadway excavation and roadway excavation in excess of that needed for construction shall become the property of the Contractor to be disposed of by him outside the limits of the right-of-way at a location suitable to the Engineer. "Unsuitable" material encountered below subgrade elevation in roadway cuts, when declared unwanted by the Engineer, shall be replaced as directed by the Engineer with material from the roadway excavation or with other suitable material.

Maintain moisture and density until covered by the subbase or base course. Remove soft or wet areas found at any time, replace with suitable material, and recompact (especially utility trenches).

(B) Subgrade Preparation

That area shown on the plans for street construction shall be cut to grade, scarified to a depth not less than 6 inches or as otherwise indicated on the drawings and compacted to 95% Standard Proctor density. Irregularities exceeding ½ inch in 16 feet shall be corrected. Soft areas found at anytime shall be removed, replaced with acceptable material and compacted (especially at utility trenches). The correct moisture density relationship shall be maintained.

(C) Curb Backfill and Topsoil (Sidewalks, Parkways, Islands, etc.)

Fill and compact areas behind curbs and adjacent to sidewalks and driveways without delay after completion of concrete work. The top 6 inches (where disturbed by construction or where unsatisfactory material is exposed by excavation) of finish earth grade shall be clean excavated material or topsoil capable of supporting a good growth of grass when fertilized and seeded or sodded. It shall be free of concrete, asphalt, shell, caliche, debris and any other material that detracts from its appearance or hampers the growth of grass.

(D) Matching Grades at Right-of-Way Line

Finish grade at the property line shall be as shown on the plans. The Engineer may require a reasonable amount of filling on private property where the sidewalk grade is above the property elevation. Use suitable material from the excavation. Unless otherwise directed, cuts at right-of-way lines shall be made at a slope of three horizontal to one vertical (3:1).

(E) Drainage

During construction, the roadbed and ditches shall be maintained in such condition as to insure proper drainage at all times, and ditches and channels shall be so constructed and maintained as to avoid damage to the roadway section.

All slopes which, in the judgment of the Engineer, require variation, shall be accurately shaped, and care shall be taken that no material is loosened below the required slopes. All breakage and slides shall be removed and disposed of as directed.

3. SELECTION OF MATERIALS

Where shown on the plans, selected materials shall be utilized to improve the roadbed, in which case the work shall be performed in such manner and sequence that suitable materials may be selected, removed separately, and deposited in the roadway within limits and at elevations required. Material used for roadway embankment shall have a plasticity index (P.I.) of 35 or less.

4. GEOGRID

Where shown on the plans, geogrid shall be placed on top of the compacted subgrade layer to strengthen the roadbed. Geogrid shall be "TENSAR BX-1200", or approved equivalent. Overlap edges of geogrid in accordance with the manufacturer's recommendations, but not less than 12 inches.

5. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 022100
SELECT MATERIAL

1. DESCRIPTION

This specification shall govern the use of select material to be used to treat designated sections of roadways, embankments, trenches, etc. Select material shall be a mixture of sand and clay or other suitable granular material. The material shall be free from vegetation, debris and clay lumps. That portion of the select material passing a 40-mesh sieve shall have a liquid limit of 45 maximum, a plasticity index range from 6 to 15, and a calculated linear shrinkage of 8.5 maximum.

2. CONSTRUCTION METHODS

Select material shall be mixed uniformly and placed in layers not to exceed 6" loose depth. The material shall be brought to approximately optimum moisture content and compacted to 95% Standard Proctor Density. Each layer shall be complete before the succeeding layer is placed.

The finished surface of the select material shall conform to the grade and section shown on the plans.

END OF SECTION

SECTION 022420
SILT FENCE

1. DESCRIPTION

This specification shall govern all work necessary for providing and installing silt fences required to complete the project.

2. MATERIAL REQUIREMENTS

A. Geotextile shall meet the requirements for temporary silt fence per AASHTO m288.

B. Fence Reinforcement Materials:

Silt fence reinforcement shall be one of the following systems.

Type 1: Self-Supported Fence - This system consists of fence posts, spaced no more than 8-1/2 feet apart, and geotextile without net reinforcement. Fence posts shall be a minimum of 42 inches long, embedded at least 1 foot, and constructed of either wood or steel. Soft wood posts shall be at least 3 inches in diameter or nominal 2 x 4 in. and essentially straight. Hardwood posts shall be a minimum of 1.5 x 1.5 in. Fabric attachment may be by staples or locking plastic ties at least every 6 inches, or by sewn vertical pockets. Steel posts shall be T or L shaped with a minimum weight of 1.3 pounds per foot. Attachment shall be by pockets or by plastic ties if the posts have suitable projections.

Type 2: Net-Reinforced Fence - This system consists of fence posts, spaced no more than 8-1/2 feet apart, and geotextile with an attached reinforcing net. Fence posts shall meet the requirements of Self-Supported Fence. Net reinforcement shall be galvanized welded wire mesh of at least 12.5-gauge wire with maximum opening size of 4 inches square. The fabric shall be attached to the top of the net at least every 2 feet, or as otherwise specified.

Type 3: Triangular Filter Dike - This system consists of a rigid wire mesh, at least 6-gauge, formed into an equilateral triangle cross-sectional shape with sides measuring 18 inches, wrapped with geotextile silt fence fabric. The fabric shall be continuously wrapped around the dike, with a skirt extending at least 12 inches from its upslope corner.

C. Packaging Requirements: Prior to installation, the fabric shall be protected from damage due to ultraviolet light and moisture by either wrappers or inside storage.

D. Certification and Identification: Each lot or shipment shall be accompanied by a certification of conformance to this specification. The shipment must be identified by a ticket or labels securely affixed to the fabric rolls. This ticket or label must list the following information:

- a. Name of manufacturer or supplier
- b. Brand name and style

- c. Manufacturer's lot number or control number
- d. Roll size (length & width)
- e. Chemical composition

END OF SECTION

SECTION 025205
PAVEMENT REPAIR, CURB, GUTTER, SIDEWALK AND DRIVEWAY REPLACEMENT

1. DESCRIPTION

This specification shall govern the removal and replacing of all types of pavements and surfacing required to complete the project.

2. MATERIALS

Unless otherwise specified on the plans, materials and proportions used along with this specification shall conform to the respective following specifications:

Section 025220 "Flexible Base - Caliche"
Section 025223 "Crushed Limestone Flexible Base"
Section 025424 "Hot Mix Asphaltic Concrete Pavement"
Section 025610 "Concrete Curb and Gutter"
Section 025612 "Concrete Sidewalks and Driveways"
Section 030020 "Portland Cement Concrete"
Section 032000 "Reinforcing Steel"
Section 038000 "Concrete Structures"

3. METHOD OF CUTTING

The outline of the trench shall be marked upon the surface of the pavement to be cut, and all cuts into the pavement shall be saw-cut as nearly vertical as it is possible to make them. All unwanted materials removed shall be disposed of by the Contractor and shall not be used as backfill material.

4. BACKFILL OF TRENCH

Excavation and backfilling of trench shall be in accordance with the construction drawings.

5. REPLACING STREET PAVEMENT

All pavements, driveways, sidewalks, and curbs and gutters which are cut shall be replaced in a workmanlike manner, with like or better materials or per pavement repair details on the drawings.

6. REPLACING DRIVEWAY PAVEMENT

On all concrete driveway pavements, the replacement shall consist of a reinforced Class "A" concrete slab with a minimum thickness of six (6) inches. The type of finish for the replaced section shall be the same as that appearing on the old pavement. Reinforcement shall be #4 bars at 12 inches each way. Any other type shall be replaced with like or better replacement.

7. REPLACING SIDEWALKS

On all sidewalk pavements, the replacement shall consist of a reinforced Class "A" concrete slab (minimum) four (4) inches thick. The type of finish for the replaced section shall be the same as that appearing on the

old sidewalk. Replacement shall, in general, be to original joint or score marks. Reinforcement shall be #4 bars at 12 inches each way on centers, located at mid-depth in the slab 4" x 4" - W2.9 x W2.9 welded wire fabric. Shell or asphalt sidewalks shall be replaced with caliche or asphalt surface.

8. REPLACING CURB AND GUTTER

On all curb and gutter, the replacement shall consist of a section conforming in all details to the original section or the Owner's Standard if required by the Engineer. Cuts through the curb shall be replaced with Class "A" concrete. Preserve original steel and reinforce all new curbs with three #4 bars. Adjust grades for positive drainage.

9. REPAIRING STREET SHOULDERS AND UNIMPROVED STREETS

On streets or roads without curb and gutter where a shoulder is disturbed, it shall be restored to like or better condition. The shoulder surface shall be rolled to an acceptably stable condition.

10. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 025208
Soil - Cement Base (S-17)

1. DESCRIPTION

This specification shall govern all work required for Soil-Cement Base necessary to complete the project.

2. MATERIALS

2.1 SOIL

Soil shall consist of approved material free from vegetation or other objectionable matter encountered in the existing roadbed and other acceptance material used in preparation of the roadbed in accordance with this specification.

2.2 PORTLAND CEMENT

Cement shall be either Type I or II Portland cement. The Contractor, at his option, may use bulk cement, provided the apparatus for handling, weighing and spreading the cement is approved by the Engineer in writing. Cement weighing equipment shall be as specified below.

2.3 WATER

Water shall be free from substances deleterious to the hardening of the cement treatment and shall be approved by the Engineer.

3. EQUIPMENT

Equipment necessary for the proper construction of the work shall be on the project, in first-class working condition, and be approved by the Engineer, both as to type and condition, prior to the start of construction operations. The Contractor shall at all times provide sufficient equipment to enable continuous execution of the work and its completion in the required number of working days.

Portland cement treatment for materials in place may be constructed with any machine or combination of machines and auxiliary equipment that will produce results as outlined in this specification.

Mixing may be accomplished by: (1) a multiple-pass traveling mixing plant or (2) a single-pass traveling mixing plant.

The equipment provided by the Contractor shall be operated by experienced and capable workmen and shall be that necessary to provide a cement treatment meeting the requirements herein specified.

4. CONSTRUCTION METHODS

4.1 GENERAL

It is the primary requirement of this specification to secure a completed course of treated material containing a uniform Portland cement mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface

suitable for placing subsequent courses. It shall be the responsibility of the contractor to regulate the sequence of his work to process a sufficient quantity of material to provide full depth as shown on plans, to use the proper amount of Portland cement, maintain the work and rework the courses as necessary to meet the above requirements.

Cement treatment shall not be mixed or placed when the air temperature is below 40F and is falling, but may be mixed or placed when the air temperature is above 35F and is rising, the temperature being taken in the shade and away from artificial heat and with the further provision that cement treatment shall be mixed or placed only when weather conditions, in the opinion of the Engineer, are suitable.

4.2 PREPERATION OF ROADBED

Before other construction operations are begun, the roadbed shall be graded and shaped as required to construct the Portland cement treatment for material in place in conformance with the lines, grades, thickness and typical cross section shown on the plans. Unsuitable soil or material shall be removed and replaced with acceptable soil.

The sub grade shall be firm and able to support without displacing the construction equipment and the compaction hereinafter specified. Soft or yielding sub grade shall be corrected and made stable before construction proceeds.

4.3 PULVERIZATION

The soil shall be so pulverized that, at the completion of moist-mixing, when all non-slaking aggregate retained on the No. 2 sieve are removed, the remaining material shall meet the following requirements when tested from the roadway in the roadway condition by

Test Method Tex-101-E (Part III).

	Percent
Minimum passing 1-inch sieve	100
Minimum passing No. 4 sieve	80

Old bituminous wearing surface shall be pulverized so that 100 percent will pass the 2-inch sieve.

4.4 APPLICATION OF CEMENT (ROAD MIX).

Portland cement shall be spread uniformly on the soil at the rate specified on the plans or approved by the Engineer. If a bulk cement spreader is used, it shall be positioned by string lines or other approved method during spreading to insure a uniform distribution of cement.

Cement shall be applied only to such an area that all the operations can be continuous and completed in daylight within 6 hours of such application.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit uniform and intimate mixture of soil and cement during dry mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture.

No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement until it is mixed with the soil.

4.5 MIXING AND PROCESSING.

Unless otherwise shown on the plans, either method (a) or (b) below may be used at the option of the Contractor.

(a) Multiple-Pass Traveling Mixing Plant. After the cement has been applied, it shall be dry-mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied. Any mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

Immediately after the dry mixing of soil and cement is complete, water as necessary shall be uniformly applied and incorporated into the mixture. Pressurized equipment and water supply provided shall be adequate to insure continuous application of the required amount of water to sections being processed within 3 hours of application of the cement. Proper care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

(b) Single-Pass Traveling Mixing Plant. After the cement has been applied it shall be sufficiently dry-mixed with the soil to prevent the formation of cement balls when water is applied. Un-pulverized soil lumps in the soil cement mixture immediately behind the mixer will not be allowed. Should this condition prevail, the Contractor shall "pre-wet" the raw soil as necessary to correct this condition. The water shall be provided with means for visibly and accurately gauging the water application. The water shall be applied uniformly through a pressure spray bar.

After cement is spread, mixing operations shall proceed as follows:

The mixer shall in one continuous operation mix the air-dry soil and cement full depth, and the required moisture uniformly, thoroughly moisten the soil, cement and water, spread the completed soil cement mixture evenly over the machine processed width of the sub grade and leave it in a loose condition ready for immediate compaction. The soil and cement mixture shall not remain undisturbed, after mixing and before compacting, for more than 30 minutes.

4.6 COMPACTION AND FINISHING.

The material shall be compacted to not less than 98% standard proctor unless otherwise shown on the plans. At the start of compaction, the percentage of moisture in the mixture and in unpulverized soil lumps, based on over-dry weights, shall not be below or more than two percentage points above the specified optimum moisture content and shall be less than that quantity which will cause the soil cement mixture to become unstable during compaction and finishing. When the un-compacted soil cement mixture is wetted by rain so that the average moisture content exceeds the tolerance given at the time of final compaction, the entire section shall be reconstructed in accordance with this specification at the sole expense of the Contractor.

Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth. The loose mixture then shall be uniformly compacted to the specified density within 2 hours.

After the soil and cement mixture, excepting the top mulch, is compacted, water shall be uniformly applied as needed and thoroughly mixed in with a spike tooth harrow or equal. The surface shall then be reshaped to its required lines, grades and cross section and then lightly scarified to loosen any imprint left by the compacting or shaping equipment.

The resulting surface shall be thoroughly rolled with a pneumatic tire roller and "clipped", "skinned" or "tight bladed" by a power grader to a depth necessary to remove all loosened soil and cement from the section. The surface shall then be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. If plus No. 4 aggregate is present in the mixture; one complete coverage of the section with the flat wheel roller shall be made immediately after the "clipping" operation. When directed by the Engineer, surface finishing methods may be varied from this procedure provided a dense, uniform surface, free of surface compaction planes, is produced. The moisture content of the surface material must be maintained at its specified optimum during all finishing operations. Surface compaction, rolling, blading and finishing shall proceed in such a manner as to produce a smooth, closely knit surface, free of cracks, ridges or loose material conforming to the crown, grade and line shown on the plans, within 3 hours of initial mixing.

5. CURING

5.1 PROTECTION AND COVER.

After the cement treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a period shown on plans but in no case less than 3 days or until the surface or subsequent courses are placed:

(a) Maintain in a thorough and continuously moist condition by sprinkling.

(b) Apply a 2-inch layer of earth on the completed course and maintain in a moist condition.

(c) Apply a single course surface treatment. Unless shown otherwise on the plans, the asphalt shall be HFRS-2, in accordance with "Asphalts, Oils and Emulsions" in the Texas Department of Highways and Public Transportation Standard Specifications. The single course surface treatment shall be placed in accordance with Section 025418 "Surface Treatment, except HFRS-2 asphalt shall be used in lieu of AC-5 and the asphalt shall be applied at .5 gallons per square yard. 5.2 Surface. The surface or other base courses may be applied on the finished base as soon after completion as operations will permit.

6. CONSTRUCTION JOINTS

At the end of each day's construction, a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true vertical face free of loose and shattered material. Cement treatment for large, wide areas shall be built in a series of parallel lanes of convenient length and width meeting and approval of the Engineer.

7. TRAFFIC

Completed sections of cement treated material in place may be opened immediately to local traffic and to construction equipment after application of the single course surface treatment and to all traffic after

the final surface course, provided the cement treated course has hardened sufficiently to prevent marring or distorting the surface by equipment or traffic.

8. MAINTENANCE

The Contractor shall be required, within the limits of his contract, to maintain the cement treated course in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the Contractor at his own expense and repeated as often as may be necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth of treatment. It is the intent of this specification that the Contractor Constructs the plan depth of cement treatment in one homogeneous mass.

9. MEASUREMENT AND PAYMENT

Unless indicated otherwise in the Proposal, Soil-Cement Base shall be measured by the square yard at each application rate specified. Measurement shall include, but not be limited to, furnishing, storing and applying cement; preparation of roadbed, application of cement, mixing, watering, compacting, finishing, curing and maintenance; and all other work as specified.

END OF SECTION

SECTION 025210
LIME STABILIZATION

1. DESCRIPTION

This specification shall consist of treating the subgrade, sub base or base by the pulverizing, addition of lime, mixing and compacting the mixed material to the required density. This specification applies to natural ground, embankment, existing pavement structure, or proposed base and shall be constructed as specified herein and in conformity with the typical sections, lines and grades as shown on the plans or as established by the Engineer.

2. MATERIALS

- (1) The lime shall be a commercially produced "Hydrated Lime" in accordance with AASHTO M216 or Type A in accordance with TEX Item 264. The specifications apply specifically to the normal hydrate of lime made from "high-calcium" type limestone. Hydrated lime for stabilization purposes shall be applied as a slurry.
- (2) Lime to be used for the treated subgrade, existing sub base, existing base or proposed base is determined by preliminary tests and shall be applied at a rate indicated on the plans.

3. EQUIPMENT

The machinery, tools and equipment necessary for proper prosecution of the work shall be on the project and approved by the Engineer prior to the beginning of construction operations.

All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

Hydrated lime shall be stored and handled in closed weatherproof containers until immediately before distribution on the road. If storage bins are used, they shall be completely enclosed. Hydrated lime in bags shall be stored in weatherproof buildings with adequate protection from ground dampness. If lime is furnished in trucks, each truck shall have the weight of lime certified on public scales.

If lime is furnished in bags, each bag shall bear the manufacturer's certified weight. Bags varying more than 5 percent from that weight may be rejected and the average weight of bags in any shipment, as shown by weighing 50 bags taken at random, shall not be less than the manufacturer's certified weight.

4. CONSTRUCTION METHODS

General – It is the primary requirement of this specification to secure a completed course of treated material containing a uniform lime mixture, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to use the proper amount of lime, maintain the work and rework the courses as necessary to meet the above requirements.

Application – Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.

Unless otherwise shown on drawings, lime shall be applied at a rate in pounds of dry-hydrated lime per square yards, in the form of a slurry. Application rate may be varied by the engineer, if conditions warrant.

Certification of lime quantity and quality shall be provided as required to monitor the application. Certification should be in the form of weight tickets which indicate the actual weight of dry hydrated lime, $CA(OH)_2$.

The application and mixing of lime with the material shall be accomplished by the method hereinafter described.

The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry.

Mixing – The mixing procedure shall be as hereinafter described.

(a) **First Mixing:** The material and lime shall be thoroughly mixed by approved road mixers or other approved equipment, and the mixing continued until, in the opinion of the Engineer, a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps. Materials containing plastic clays or other material which will not readily mix with lime shall be mixed as thoroughly as possible at the time of the lime application, brought to the proper moisture content and left to cure 1 to 4 days as directed by the Engineer. During the curing period, the material shall be kept moist as directed.

(b) **Final Mixing:** After the required curing time, the material shall be uniformly mixed by approved methods. If the soil binder-lime mixture contains clods, they shall be reduced in size by raking, blading, disking, harrowing, scarifying or the use of other approved pulverization methods so that, when all nonslaking aggregates retained on the No. 4 sieve are removed, the remainder of the material shall meet the following requirements when tested dry by laboratory sieves:

	<u>Percent</u>
Minimum Passing 1" Sieve.....	100
Minimum Passing No. 4 Sieve.....	85

Old bituminous wearing surface shall be pulverized so that 100% will pass a 2" sieve.

During the interval of time between applications and mixing, hydrated lime that has been exposed to the open air for a period of 6 hours or more or to excessive loss due to washing or blowing will not be accepted for payment.

Compaction – Compaction of the mixture shall begin immediately after final mixing and in no case later than 3 calendar days after final mixing, unless approval is obtained from the Engineer. The material shall be aerated or sprinkled as necessary to provide the optimum moisture. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted as hereinafter specified.

If the total thickness of the material to be treated cannot be mixed in one operation, the previously

mixed material shall be bladed to a windrow just beyond the area to be treated and the next layer mixed with lime as previously specified. The first layer of the material shall be compacted such that the treated material will not be mixed with the underlying material.

The course shall be sprinkled as required to maintain moisture content on the wet side of optimum and compacted to the extent necessary to provide the specified density. Unless shown otherwise on the drawings, all lime treated subgrades, sub bases, and bases are not in direct contact with surface or binder course shall be compacted to a minimum of 98% Standard Proctor (AASHTO T99).

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests as necessary will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements.

Rework, when required to meet pulverization requirements or density, shall include the addition of lime, about 10% to 15% of the initial application rate or as deemed necessary by the Engineer. A new optimum density will be obtained.

Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface, upon completion, shall be smooth and in conformity with the typical section shown on the plans and to the established lines and grades.

5. MEASUREMENT & PAYMENT

Unless indicated otherwise in the Proposal, Lime for stabilization of bases, sub bases and subgrade shall be measured by the square yards.

Pulverizing, mixing, watering grading, compacting, working material etc., shall not be measured for pay but shall be subsidiary to other work.

END OF SECTION

SECTION 025213
ASPHALT STABILIZED BASE (S-26)

1. DESCRIPTION

"Asphalt Stabilized Base" shall consist of base courses, subbase courses, or foundation courses to be composed of a compacted mixture of mineral aggregate and asphaltic material mixed hot in a mixing plant.

2. MATERIALS

(a) Asphalt: Asphalt for the mixture shall be of the type and grade as determined by the Engineer and shall meet the requirements of Section 025404 entitled "Asphalts, Oils, and Emulsions".

(b) Tack Coat: The asphaltic material for tack coat shall meet the requirements for emulsified asphalt EA-11M or shall be a cutback asphalt made by combining 50 to 70 percent by volume of the asphaltic material specified for the paving mixture with 30 to 50 percent by volume of gasoline or kerosene. Asphaltic materials shall meet the requirements of Section 025404 entitled "Asphalts, Oils, and Emulsions".

(c) Mineral Aggregate: The material shall consist of durable coarse aggregate particles, crushed or uncrushed, with approved binding materials and screened as necessary to meet the following gradation requirements.

<u>Square Sieve Size</u>	<u>Percent Retained by Weight</u>
2"	0
1-1/4"	0-2
#4	45-75
#40	60-85

The mineral aggregate shall also meet the following physical requirements.

Wet Ball Mill	50 max.
Plasticity Index (P.I.)	15 max.
Liquid Limit (L.L.)	55 max.
Sand equivalent value shall not be less than 40	

Testing of mineral aggregates shall be in accordance with the appropriate Texas Highway Department standard laboratory test procedures.

3. MIXTURE

The mixture shall be uniform and shall contain 6.0 percent by weight of asphaltic material. Samples of the material, when tested, shall not vary from the designated asphalt content by more than 0.5 percent dry weight (based on total mixture).

4. EQUIPMENT

Equipment used in mixing, spreading, finishing, and compacting the material shall conform to the requirements of Section 025424 entitled "Hot Mix Asphaltic Concrete Pavement", Subsection 4 entitled "Equipment".

5. STOCKPILING, STORAGE, PROPORTIONING, AND MIXING

These requirements shall be as specified in Section 025424, Subsection 5.

6. CONSTRUCTION METHODS

Construction methods shall conform to the requirements of Section 025424, Subsection 6.

7. MEASUREMENT AND PAYMENT

Asphalt stabilized base shall be measured by the square yard. Payment shall be made at the contract unit bid price, per square yard, and shall constitute full compensation for all labor, material, equipment, and incidentals necessary to complete the asphalt stabilized base course in accordance with this specification and to the lines, grades, thickness, and typical section shown on the plans.

END OF SECTION

SECTION 025215
CEMENT STABILIZED CALICHE BASE (S-47)

1. DESCRIPTION

This specification shall govern all work required to furnish and place all cement stabilized caliche base for this project.

2. MATERIALS

1. Raw Caliche Base: Sample for testing shall be taken prior to mixing with cement.

Material shall be well graded and meet the following requirements when tested in accordance with AASHTO T27:

<u>Sieve Size</u>	<u>% Passing</u>
2"	100
1"	75-95
3/8"	40-75
No. 4	30-60
No. 10	20-45
No. 40	15-30
No. 200	5-20

The material passing the No. 40 sieve, soil binder, shall meet the following requirements:

- a. Liquid limit shall not exceed 45 when tested in accordance with AASHTO T89.
- b. Plasticity index shall not exceed 20 when tested in accordance with AASHTO T90.
- c. Linear shrinkage shall not exceed 10 when tested in accordance with THD TEX-107-E. (Note: The linear shrinkage shall be calculated from the volumetric shrinkage at the liquid limit.)

Coarse aggregate shall have an abrasion loss of not more than 55% when subjected to the Los Angeles Abrasion Test, AASHTO T96.

2. Water: Water shall be free of substances deteriorative to curing of the treated base and shall be approved by the City Engineer.

3. Cement: Cement shall be Type 1 Portland Cement in accordance with ASTM C150. Cement shall be applied in the amount necessary to produce the desired compressive strength in the finished and cured base, depending on raw caliche used. In most cases, acceptable raw caliche will require cement in the following amount:

Percent by Weight = 7
lb. per sq. yd. for 1" depth = 5.57

In the absence of more precise data, the above amount has been used to estimate the quantity of Portland Cement in the proposal. The Engineer may increase or decrease the amount of cement at his discretion, after representative samples of the caliche have been tested.

4. Asphalt Seal: Asphalt Seal shall be MC70 in accordance with 025404.

3. EQUIPMENT

Equipment necessary for the proper construction of the work shall be on the project, in first-class working condition, and be approved by the Engineer, both as to type and condition, prior to the start of construction operations. The Contractor shall at all times provide sufficient equipment to enable continuous prosecution of the work and its completion in the required number of working days.

Portland Cement treatment for materials in place may be constructed with any machine or combination of machines and auxiliary equipment that will produce results as outlined in this specification.

Mixing may be accomplished by: (1) a multiple-pass traveling mixing plant or (2) a single-pass traveling mixing plant.

The equipment provided by the Contractor shall be operated by experienced and capable workmen and shall be that necessary to provide a cement treatment meeting the requirements herein specified.

4. CONSTRUCTION METHODS

4.1 GENERAL

It is the primary requirement of this specification to secure a complete course of treated material containing a uniform Portland cement mixture free from laminations or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work to process a sufficient quantity of material to provide full depth as shown on plans, to use the proper amount of Portland cement, maintain the work and rework the courses as necessary to meet the above requirements.

Cement treatment shall not be mixed or placed when the air temperature is below 40E and is falling, but may be mixed or placed when the air temperature is above 35E F and is rising, the temperature being taken in the shade and away from artificial heat and with the further provisions that cement treatment shall be mixed or placed only when weather conditions, in the opinion of the Engineer, are suitable.

4.2 TEST SECTION

The Contractor shall be required to construct a "Test Section". The first section of cement treated base shall serve as a test section. Its length shall be between 300 and 500 linear feet, typically one block. Evaluation of the equipment and procedure will be done during this section. In case it is found that the work is not satisfactory with respect to the specification requirements, the Contractor shall revise his procedures and augment or replace equipment as necessary to assure work completed in accordance with the specifications. Additional test sections may be required as directed by the Engineer. Test sections not conforming to the requirements of the specifications shall be reconstructed.

4.3 PLACING OF BASE MATERIAL

After approval of the previous course, base material shall be delivered on the road and placed in windows of uniform sections, then accurately bladed and shaped to required crown and grade to provide a base of compacted depth required by the plans.

4.4 FINAL PREPARATION OF SECTION

On the day immediately preceding processing, water, as required, shall be added and uniformly mixed full depth with the base material. This operation shall precede cement spreading by at least 12 hours. The section shall then be accurately bladed and shaped to required grade and section.

4.5 APPLICATION OF CEMENT

The specified quantity of Portland Cement required for the full depth of treatment shall be uniformly spread over the surface. Each pass of the cement spreader shall be positioned by either the curb line or a string line. Cement shall be applied only to such areas as can be completed as herein specified within the daylight hours of the same day. No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement until it is mixed with the base material.

4.6 MIXING AND PROCESSING:

Either method (a) or (b) below may be used at the option of the Contractor.

(a) Multiple-Pass Traveling Mixing Plant: After the cement has been applied, it shall be mixed with the base material. Mixing shall continue until the cement has been sufficiently blended with the base material to prevent the formation of cement balls when water is applied. Any mixture that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

Immediately after the mixing of base material and cement is completed, water, as necessary, shall be uniformly applied and incorporated into mixture. Proper care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

(b) Single-Pass Traveling Mixing Plant: After the cement has been applied, it shall be sufficiently mixed with the base material to prevent the formation of cement balls when water is applied. Unpulverized soil lumps in mixture will not be allowed. Should this condition prevail, the Contractor shall "pre-wet" the raw base material as necessary to correct this condition.

The mixer shall be provided with means for visible and accurately gauging the water application. The water shall be applied uniformly through a pressure spray bar. After cement is spread, mixing operations shall proceed as follows:

The mixer shall, in one continuous operation, mix the base material and cement full depth, add the required moisture uniformly, thoroughly moist-mix the material, cement, and water, spread the completed mixture evenly over the machine processed width of the subgrade, and leave it in a loose condition ready for immediate compaction.

The mixture shall not remain undisturbed, after mixing and before compacting, for more than 30 minutes.

4.7 COMPLETION AND FINISHING

The material shall be compacted to not less than 98 percent of the maximum dry density as determined by AASHTA T99 Method D. The moisture content of the mixture shall be within 3% of optimum on the wet side.

The surface, upon completion, shall be smooth and in conformity with typical sections and to the established lines and grades. Any deviation in excess of 1/4 inch in cross section and in a length of 16 feet measured longitudinally shall be corrected. All irregularity, depressions, or weak spots which develop shall be corrected by re-priming.

All sections of cement stabilized base shall be processed full width each day without longitudinal construction joints.

Any portion which has a density below that specified herein and which has not properly hardened after a suitable time interval shall be removed and replaced to meet this specification at the expense of the Contractor.

4.8 ASPHALT SEAL

The compacted cement treated base course shall be protected against rapid drying by priming the surface in accordance with 025412. This curing seal shall be applied as soon as practicable, but not later than eight hours after the completion of final compaction. The surface shall be kept moist until the curing seal is applied. It shall be the responsibility of the Contractor to protect the primed surface until surface course is applied.

4.9 TRAFFIC

The Contractor shall not be permitted to drive heavy equipment over completed portions, but pneumatic-tired equipment required for hauling cement, and water may be permitted after the surface has hardened sufficiently to prevent the equipment from marring the surface, provided protection and cover specified herein are not impaired. The cement stabilized base may be opened to local traffic as soon as the asphalt seal has been applied and sanded or cured as necessary to prevent it from being picked up by traffic. It may be opened to all traffic after 7 days. Surface course shall be applied prior to opening to through traffic.

4.10 MAINTENANCE

The Contractor shall be required to maintain at his own expense the entire cement stabilized base within the limits of his contract in good condition satisfactory to the Engineer from the time he first starts work until all work shall have been completed.

Maintenance shall include immediate repairs of any defect that may occur after construction, which work shall be done by the Contractor at his own expense and repeated as often as necessary to keep the

area continuously intact. Repairs are to be made in a manner to insure restoration of a uniform surface of good quality cement stabilized base. Faulty work shall be replaced for the full depth of base. Any low area shall be remedied by replacing the material for the full depth of treatment, rather than adding a thin layer of base material to the completed work.

5. MEASUREMENT AND PAYMENT

Unless indicated otherwise in the Proposal, Cement Stabilized Base will be measured by the square yard, complete in place, for the thickness specified on the plans. Areas will be measured separately for the various thicknesses of Cement Stabilized Base. Portland Cement, actually incorporated in the completed work, will be measured by the ton.

SECTION 025223
FLEXIBLE BASE

1. DESCRIPTION

This Specification shall govern all work for furnishing and placing Flexible Base required to complete the project.

2. MATERIAL

The material shall consist of crushed limestone produced from oversize quarried aggregate, sized by crushing and produced from a naturally occurring single source, meeting the requirements for Type 'A' material as specified in Texas Department of Transportation (TxDOT) Specification Item 247 "Flexible Base". Crushed gravel or uncrushed gravel shall not be acceptable. No blending of sources and/or additive materials will be allowed. The material shall be free of vegetation and shall be approved by the Engineer. All acceptable material shall be screened and the oversize shall be crushed and returned to the screened material in such a manner that a uniform product will be produced which meets all physical requirements for Grade 1-2 as specified in TxDOT Specification Item 247 "Flexible Base".

3. TESTING

The Owner will engage a laboratory and pay for one test each in the following categories: gradation, liquid limit, plasticity index, modified proctor, moisture-density relation, CBR, and necessary field densities. The Engineer may call for additional tests at any time. The cost of all retests, in case of failure to meet specifications, will be deducted from the Contractor's payment. The Owner will pay for proctor and soil constants and abrasion tests, at the rate of one test for each 1,500 square yards. If material changes and this ratio of one test increases, the Contractor shall pay the cost of additional tests required by the Engineer. The Engineer may waive testing and/or lime admix for small amounts for unimportant uses.

4. CONSTRUCTION METHODS

Prior to placement of flexible base, the surface of the previous course shall be finished true to line and grade as established, and in conformity with the typical section shown on the plans. Grade tolerance shall be generally 1/2 inch, and highs and lows must approximately balance.

Flexible base shall be delivered and spread the same day if possible (no later than the next day).

Base shall be mixed as required to produce a uniform mixture with water. Base shall be placed in uniform lifts not to exceed 6 inches and compacted to a minimum of 95 percent Modified Proctor density (ASTM D1557 or AASHTO T180) at a moisture content of not less than two (2) percent below optimum moisture nor more than 2 percent above optimum moisture.

The surface of the compacted base, after meeting moisture/density requirements, shall be primed in accordance with Standard Specification Section 025412 "Prime Coat".

On completion of compaction and priming, the surface shall be smooth and conform to lines, grades, and sections shown on the plans. Areas with any deviation in excess of 1/4 inch in cross-section and in lengths of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping, and recompacting by repriming and rolling.

Moisture and density shall be maintained until the paving is complete.

5. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 025412
PRIME COAT

1. DESCRIPTION

This specification shall consist of an application of asphalt material on the completed base course and/or other approved area in accordance with this specification.

Prime Coat shall not be applied when the air temperature is below 60° F and falling, but it may be applied when the air temperature is above 50° F and is rising; the air temperature being taken in the shade and away from artificial heat. Asphalt material shall not be placed when general weather conditions, in the opinion of the Engineer, are not suitable.

2. MATERIALS

The asphalt material used for the prime coat shall be MC-30 medium-curing cutback asphalt or AE- P asphalt emulsion prime, unless otherwise specified, and when tested by approved laboratory methods shall meet the requirements of Standard Specification Section 025404 "Asphalts, Oils and Emulsions". Blotter material shall be native sand.

3. CONSTRUCTION METHODS

When, in the opinion of the Engineer, the area and/or base is satisfactory to receive the prime coat, the surface shall be cleaned of dirt, dust, and other deleterious matter by sweeping or other approved methods. If found necessary by the Engineer, the surface shall be lightly sprinkled with water just prior to application of the asphalt material. The asphalt material shall be applied on the clean surface by an approved type of self-propelled pressure distributor so operated as to distribute the material in the quantity specified, evenly and smoothly under a pressure necessary for proper distribution. The Contractor shall provide all necessary facilities for determining the temperature of the asphalt material in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two distributor loads.

All storage tanks, piping, retorts, booster tanks and distributors used in storing or handling asphalt material shall be kept clean and in good operating condition at all times, and they shall be operated in such manner that there will be no contamination of the asphalt material with foreign material. It shall be the responsibility of the Contractor to provide and maintain in good working order a recording thermometer at the storage-heating unit at all times. The distributor shall have been recently calibrated and the Engineer shall be furnished an accurate and satisfactory record of such calibration. After beginning of the work, should the yield on the asphalt material applied appear to be in error, the distributor shall be calibrated in a manner satisfactory to the Engineer before proceeding with the work.

Prime shall be applied at a temperature within the recommended range per Standard Specification Section 025404 "Asphalts, Oils and Emulsions", with that range being 70 to 150 degrees F. Application rate shall be not less than 0.15 gallon per square yard, unless otherwise specified. The Contractor shall be responsible for the maintenance of the surface until the Engineer accepts the work.

No traffic hauling or placement of any subsequent courses shall be permitted over the freshly applied prime coat until authorized by the Engineer. Spread blotter material before allowing traffic to use a primed surface.

Allow sufficient time for the prime coat to cure properly before applying surface treatment or asphaltic concrete pavement.

4. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 025414
AGGREGATE FOR SURFACE TREATMENT AND SEAL COATS

1. DESCRIPTION

This specification establishes the requirements for aggregate, lightweight aggregate, and precoated to be used in the construction of surface treatments and seal coats. The type of aggregate shall be as specified in the applicable specification.

2. AGGREGATE

- (1) Materials. Aggregates shall be composed of clean, tough and durable particles of gravel, crushed gravel, crushed stone, crushed slag or natural limestone rock asphalt. These materials shall not contain more than 5 percent by weight of soft particles and other deleterious materials as determined by Test Method Tex-217-F, Part I.

The natural limestone rock asphalt aggregate furnished shall have an average bitumen content from 4 to 8 percent by weight of naturally impregnated asphalt, as determined by Test Method Tex-215-F, and shall not contain not more than 2 percent by weight of any one of or combination of iron pyrites, or other objectionable matter, as determined by Test Method Tex-217-F, Part I.

No aggregate shall contain a total of more than 5 percent by weight of impurities or objectionable matter listed above.

The percent of wear, as determined by Test Method Tex-410-A, for each of the materials shall not exceed 35 percent.

The percent of wear on natural limestone rock asphalt aggregate as determined by Test Method Tex-410-A shall be made on that portion of the material retained on the NO. 4 sieve, having a naturally impregnated asphalt content of less than 1 percent.

Crushed gravel shall have a minimum of 85 percent of the particles retained on the NO. 4 sieve with at least one crushed face, as determined by Test Method Tex-1413-A.

- (2) Types. The various types of aggregates are identified as follows:

Type A. Type A aggregate shall consist of gravel, crushed slag, crushed stone or natural limestone rock asphalt.

Type B. Type B aggregate shall consist of crushed gravel, crushed slag, crushed stone or natural limestone rock asphalt.

Type C. Type C. aggregate shall consist of gravel, crushed slag or crushed stone.

Type D. Type D aggregate shall consist of crushed gravel, crushed slag or crushed stone.

Type E. Type E aggregate shall consist of natural limestone rock asphalt.

- (3) Grades: When tested by Test Method Tex-200-F, Part I, the graduation requirements for the several grades of aggregate shall be as follows:

<u>(a) Class A</u>		<u>Percent by weight</u>
Grade 1:	Retained on 7/8" sieve	0
	Retained on 3/4" sieve	0 - 5
	Retained on 5/8" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 2:	Retained on 3/4" sieve	0
	Retained on 5/8" sieve	0 - 5
	Retained on 1/2" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on 1/4" sieve	99 - 100
Grade 3:	Retained on 5/8" sieve	0
	Retained on 1/2" sieve	0 - 5
	Retained on 3/8" sieve	85 - 100
	Retained on 1/4" sieve	95 - 100
	Retained on No. 10 sieve	95 - 100
Grade 4:	Retained on 1/2" sieve	0
	Retained on 3/8" sieve	0 - 5
	Retained on 1/4" sieve	95 - 100
	Retained on No.10 sieve	99 - 100
Grade 5:	Retained on 3/8" sieve	0
	Retained on 1/4" sieve	0 - 5
	Retained on No. 4 sieve	50 - 100
	Retained on No. 10 sieve	99 - 100

<u>(b) Class B</u>		<u>Percent by Weight</u>
Grade 1:	Retained on 1" sieve	0
	Retained on 7/8" sieve	0 - 2
	Retained on 3/4" sieve	20 - 35
	Retained on 5/8" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100

<u>(b) Class B</u>		<u>Percent by Weight</u>
Grade 2:	Retained on 7/8" sieve	0

	Retained on 3/4" sieve	0 - 2
	Retained on 5/8" sieve	20 - 35
	Retained on 1/2" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 3:	Retained on 3/4" sieve	0
	Retained on 5/8" sieve	0 - 2
	Retained on 1/2" sieve	20 - 35
	Retained on 3/8" sieve	85 - 100
	Retained on 1/4" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 4:	Retained on 5/8" sieve	0
	Retained on 1/2" sieve	0 - 2
	Retained on 3/8" sieve	20 - 35
	Retained on No. 4 sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 5:	Retained on 3/8" sieve	0
	Retained on 1/4" sieve	0 - 5
	Retained on No. 10 sieve	99 - 100

The aggregate shall not contain more than 1.0 percent by weight of fine dust, clay-like particles and/or silt present when tested in accordance with Test Method Tex-217-F, Part II.

3. LIGHTWEIGHT AGGREGATE

(1) Materials. Aggregate shall be composed predominately of lightweight cellular and granular inorganic materials produced by fuzing raw shale or clay in a rotary kiln under intense heat into predominantly amorphous silicate. All aggregate for use on this project shall be produced from the same plant and source.

The dry loose unit weight of coarse lightweight aggregates shall not be less than 35 and shall not exceed 55 pounds per cubic foot unless otherwise specified on the plans. If the unit weight of any shipment of lightweight aggregate differs by more than 4 percent from that of the sample submitted for acceptance tests, the aggregate in the shipment may be rejected. Tests shall be in accordance with Test Method Tex-410-A, Part C. The percent of wear, as determined by Test Method Tex-410-A shall not exceed 35 percent.

The Aggregate Freeze Thaw Loss shall not exceed 7 percent when tested in accordance with Texas Test Method Tex-432-A (Tentative).

The Pressure Slaking Value shall not exceed 4 percent when tested in accordance with Test Method Tex-431-A, (Tentative).

(2) Grades. When tested by Test Method Tex-200-F, Part I, the gradation requirements for the several grades of aggregate shall be as follows:

		<u>Percent by Weight</u>
Grade 3:	Retained on 3/4" sieve	0
	Retained on 5/8" sieve	0 - 5
	Retained on 1/2" sieve	30 - 50
	Retained on 3/8" sieve	85 - 100
	Retained on 1/4" sieve	95 - 100
	Retained on No. 10 sieve	98 - 100
Grade 4:	Retained on 5/8" sieve	0
	Retained on 1/2" sieve	0 - 5
	Retained on 3/8" sieve	20 - 40
	Retained on No. 4 sieve	95 - 100
	Retained on No. 10 sieve	98 - 100
Grade 5:	Retained on 1/2" sieve	0
	Retained on 3/8" sieve	0 - 2
	Retained on No. 4 sieve	60 - 80
	Retained on No. 10 sieve	98 - 100

The aggregate shall not contain more than 1.0 percent by weight of fine dust, clay-like particles and/or silt present when tested in accordance with Test Method Tex-217-F, Part II.

4. PRECOATED AGGREGATES

Precoated aggregate shall be aggregates of the type specified, treated (coated or fluxed) with 0.5 to 1.5 percent by weight of precoat material of flux oil meeting the requirements of this specification and the approval of the Engineer. The particular grade of precoated aggregate specified shall meet all requirements of Section 025414.3 (2) prior to the application of the precoat material.

- (1) Water in an amount not to exceed 3 percent by weight of the mixture may be used in preparing the mixture. The water shall be added as directed by the Engineer during the mixing. In the event water is used in the mixing operation adequate measuring devices shall be used and the water shall be administered to the mix through as approved spray bar.
- (2) Physical Properties of the Mixture. The materials may be mixed on the job or at some central mixing plant and shipped ready for use. Mixes that do not remain workable a sufficient period of time or maintain flow qualities such that the precoated aggregate may be satisfactorily spread by normal approved mechanical spreading devices will not be acceptable.

Materials that are not uniformly and/or properly coated or fluxed, as determined by the Department's standard testing procedures or in the opinion of the Engineer, will not be accepted for use.

- (3) Materials. Aggregate for precoated aggregate shall be the same as specified in Section 025414.2 (1).

The precoat material shall meet the requirements for "Precoated Materials" as specified in the specification, Section 025404 "Asphalts, Oils and Emulsions".

The flux oil shall meet the requirement for "Flux Oil" as specified in the specification, Section 025404 "Asphalt, Oils and Emulsions".

- (4) Types. The various types of precoated aggregates are identified as follows:

Type PA: Type PA shall be precoated aggregate consisting of crushed gravel, crushed slag, crushed stone or natural limestone rock asphalt.

Type PB: Type PB shall be precoated aggregate consisting of crushed gravel, crushed slag, crushed stone or natural limestone rock asphalt.

Type PC: Type PC shall be precoated aggregate consisting of gravel, crushed slag or crushed stone.

Type PD: Type PD shall be precoated aggregate consisting of crushed gravel, crushed slag or crushed stone.

Type PE: Type PE shall be precoated aggregate consisting of natural limestone rock asphalt.

- (5) Grades. When tested by Test Method Tex-200-F, Part I, the gradation requirements for the several grades of aggregate shall be as follows:

(a) Class A

		<u>Percent by weight</u>
Grade 1:	Retained on 7/8" sieve	0
	Retained on 3/4" sieve	0 - 5
	Retained on 5/8" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 2:	Retained on 3/4" sieve	0
	Retained on 5/8" sieve	0 - 5
	Retained on 1/2" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on 1/4" sieve	99 - 100
Grade 3:	Retained on 5/8" sieve	0
	Retained on 1/2" sieve	0 - 5
	Retained on 3/8" sieve	85 - 100
	Retained on 1/4" sieve	95 - 100
	Retained on No. 10 sieve	95 - 100

Grade 4:	Retained on 1/2" sieve	0
	Retained on 3/8" sieve	0 - 5
	Retained on 1/4" sieve	95 - 100
	Retained on No.10 sieve	99 - 100
Grade 5:	Retained on 3/8" sieve	0
	Retained on 1/4" sieve	0 - 5
	Retained on No. 4 sieve	50 - 100
	Retained on No. 10 sieve	99 - 100

(b) Class B

Percent by Weight

Grade 1:	Retained on 1" sieve	0
	Retained on 7/8" sieve	0 - 2
	Retained on 3/4" sieve	20 - 35
	Retained on 5/8" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 2:	Retained on 7/8" sieve	0
	Retained on 3/4" sieve	0 - 2
	Retained on 5/8" sieve	20 - 35
	Retained on 1/2" sieve	85 - 100
	Retained on 3/8" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100
Grade 3:	Retained on 3/4" sieve	0
	Retained on 5/8" sieve	0 - 2
	Retained on 1/2" sieve	20 - 35
	Retained on 3/8" sieve	85 - 100
	Retained on 1/4" sieve	95 - 100
	Retained on No. 10 sieve	99 - 100

Class "B"

Percent by Weight

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

The aggregate shall not contain more than 1.0 percent by weight of fine dust, clay-like particles and/or silt present when tested in accordance with Test Method Tex-217-F, Part II.

(6) Equipment.

- A. Mixing Plants. Mixing plants that will not continuously meet all the requirements of this specification shall be condemned.

Mixing plant may be either the weight-batching type or the continuous mixing type. Both types of plants shall be equipped with satisfactory conveyors, power units, aggregate handling equipment, aggregate screens and bins and shall consist of the following essential pieces of equipment:

(A) Weight-batching Type

Cold aggregate Bin and Proportioning Device. The cold aggregate bins or aggregate stockpiles shall be of sufficient number and size to supply the amount of aggregate required to keep the plant in continuous operation. The proportioning device shall be such as will provide a uniform and continuous flow of aggregate in the desired proportion to the plant.

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

The burner, or combination of burners, the type of fuel used shall be such that in the process of heating the aggregate to the desired or specified temperatures, no residue from the fuel shall adhere to the heated aggregate. A recording thermometer shall be provided which will record the temperature of the aggregate when it leaves the dryer. The dryer shall be of sufficient size to keep the plant in continuous operation. The dryer will not be required for precoating natural limestone rock asphalt.

Screening and Proportioning The screening capacity and size of the bins shall be sufficient to screen and store the amount of aggregate required to properly operate the plant and keep the plant in continuous operation at full capacity. Proper provisions shall be made to enable inspection forces to have easy and safe access to the proper location on the mixing plant where accurate representative samples of aggregate may be taken from bins for testing.

Weighing and Measuring Equipment. The weighing and measuring equipment shall be of sufficient capacity and of adequate design for proper batching. The following equipment shall be furnished:

1. Aggregate weight box and batching scales.
2. Bucket and scales for precoat material or flux oil.

A pressure type flow meter may be used to measure the precoat material or flux oil for each batch.

Mixer. The mixer shall be of the pug mill type, and shall have a capacity of not less than 3000 pounds in a single batch. The number of blades circulation bar that will distribute the precoat material or flux oil quickly and uniformly throughout the mixer. Any mixer that has

a tendency to segregate the mineral aggregate or fails to secure a thorough and uniform mixing with the precoat material or flux oil shall not be used. All mixers shall be provided with an automatic time lock that will lock the discharge doors of the mixer for the required mixing period. The dump doors or doors and the shaft seals of the mixer shall be tight enough to prevent the spilling of aggregate or mixture from the pug mill.

(B) Continuous Mixing Type

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

Dryer. Same as for weight-batching type of plant.

Screening and Proportioning. Same as for weight-batching type of plant. These requirements shall also apply to materials that are stockpiled and that are proposed for direct use by a continuous mixing plant without the use of plant bins.

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

Spray Bar for Precoat Materials and Flux Oil. The spray bar the precoat material or flux oil shall be so designed that the material will spray uniformly and continuously into the mixer.

Meter for Precoat Materials and Flux Oil. An accurate recording meter for precoat material or flux oil shall be placed in the line leading to the spray bar so that the accumulative amount of precoat material or flux oil being used can be accurately determined. Provisions of a permanent nature shall be made for checking the accuracy of the meter output.

Mixer. The mixer shall be of the pug mill continuous type and shall have a capacity of not less than 40 tons of mixture per hour. Any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixing of the aggregate with the precoat material or flux oil shall not be used.

Heating Equipment for Precoat Material and Flux Oil. Heating equipment for precoat material and flux oil shall be adequate to heat the amount of material required to the desired temperature. The material may be heated by steam coils which shall be absolutely tight. Direct fire heating will be permitted, provided the heater used is manufactured by a reputable concern and there is positive circulation of the liquid throughout the heater. Agitation with steam or air will not be permitted. The heating apparatus shall be equipped with a recording thermometer with a 24-hour chart that will record the temperature of the precoat material or flux oil where it is at the highest temperature.

(C) Storage, Proportions and Mixing

A. Aggregate Storage. If the mineral aggregates are stored or stockpiled, they shall be handled in such a manner as to prevent segregation, the mixing of the various materials or sizes, and the contamination with foreign materials. The grading of aggregates proposed for use and as supplies to the mixing plant shall be uniform.

The use of limestone rock asphalt aggregate containing moisture in excess of the saturated surface-dry condition will not be permitted. Excess moisture will be evidenced by visual surface moisture on the aggregate or any unusual quantities of fines clinging to the aggregate.

B. Storage and Heating of Precoat or Flux Oil. The precoating or fluxing material storage shall be sampled to meet the requirements of the plant. The materials shall not be heated to a temperature in excess of 250° F. All equipment used in the storage and handling of precoat material or flux oil shall be kept in a clean condition at all times and shall be operated in such manner that there will be no contamination with foreign matter.

C. Feeding and Drying of Aggregate. The feeding of various sizes of aggregate, other than natural limestone rock asphalt, to the dryer shall be done through the cold aggregate bin and proportioning device in such a manner that a uniform and constant flow of material in the required proportions will be maintained.

D. Proportioning. The proportioning of the various materials entering into the mixture shall be as directed by the Engineer and in accordance with these specifications. Aggregate shall be proportioned by weight using the weight box and batching scales herein specified when the weight-batch type of plant is used and by volume using the aggregate proportioning devices when the continuous mixer type of plant is used. The precoat material or flux oil shall be proportioned by weight or by volume based on weight using the specified equipment.

E. Mixing.

(1) Batch Type Mixer. In the charging of the weigh box and in the charging of the mixer from the weigh box, such methods or devices shall be used as are necessary to secure a uniform mixture. In introduce the batch into the mixer, the mineral aggregate shall be introduced first; shall be mixed thoroughly, as directed, to uniformly distribute the various sizes throughout the batch before the precoat material or flux oil is added; the precoat material or flux oil shall then be added and the mixing continued until such time that the aggregate is properly coated. This mixing period may be varied, if in the opinion of the Engineer, the mixture is not uniform.

(2) Continuous Type Mixer. The amount of aggregate and precoat material or flux oil entering the mixer and the rate of travel through specified grading and percent by weight of precoat material or flux oil will be produced.

END OF SECTION

SECTION 025416
SEAL COAT

1. DESCRIPTION

This specification shall consist of a surface treatment composed of a single or multiple application of asphalt covered with aggregate for the sealing of existing pavements in accordance with this specification.

Seal coats shall not be applied when the air temperature is below 60°F and falling, but may be applied when the air temperature is above 50°F and rising; the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Engineer, are not suitable.

2. MATERIALS

(1) Asphaltic Materials. The asphaltic material used shall be AC-5 (AC-3 in winter) or other approved material as prescribed in Standard Specification Section 025404 "Asphalts, Oils and Emulsions", whichever is called for on the plans.

(2) Aggregate.

Single Course - The aggregate used shall be Type PA (pre-coated aggregate), Grade 5 (1/2" maximum size), as described in specification Section 025414 "Aggregate for Surface Treatment".

Multiple Course - The aggregate used for multiple course seal coat shall be the same as for single course, except Grade 4 (5/8" maximum size) aggregate will be required for the first course, and Grade 5 (1/2" maximum size) aggregate will be required for the second and third (surface) courses, as shown in the plans and specifications.

3. CONSTRUCTION METHODS

The area to be treated shall be cleaned of dirt, dust or other deleterious matter by sweeping or other approved methods. If it is found necessary by the Engineer, the surface shall be lightly sprinkled with water just prior to the application of asphaltic material. Asphaltic material shall be applied on the cleaned surface by an approved type of self-propelled pressure distributor, so operated as to distribute the material in the quantity specified, evenly and smoothly, under a pressure necessary for proper distribution. The Contractor shall provide all necessary facilities for determining the temperature of the asphaltic material in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two distributor loads. The distributor shall have been recently calibrated, and the Engineer shall be furnished an accurate and satisfactory record of such calibration. After beginning the work, should the yield on the asphaltic material appear to be in error, the distributor shall be calibrated in a manner satisfactory to the Engineer before proceeding with the work. Asphaltic material may be applied for the full width of the seal coat in one application unless the width exceeds 26 feet. Asphaltic material shall not be applied until immediate covering with aggregate is assured. Immediately after the application of asphalt, the aggregate shall be evenly spread over the surface. Mechanical spreading devices shall be of a type approved by the Engineer. The cover material must be evenly and accurately distributed to the end that an even and smooth surface is

obtained. Immediately after the aggregate has been applied, the surface shall be adequately raked and broomed to insure uniformity. As soon as proper distribution of aggregate can be obtained, the surface shall be flat-rolled with a roller having a gross weight of not less than four (4) tons and not more than ten (10) tons. The Contractor shall so arrange his work that the rolling of all aggregate applied that day shall be completed on the road before daylight. The asphalt and aggregate shall be applied at the approximate rate indicated on plans within the limits of the following schedule or as directed by the Engineer.

	Gallons of Asphalt		Aggregate	
	Per Square Yard		Cu.Yd. to Sq.Yd.	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Asphalt Cement.....	0.15	0.30	1.200	1.100

The Contractor shall be responsible for the maintenance of the surface until the work is accepted by the Engineer. All holes or failures in the seal coat surface shall be repaired by use of additional asphalt and aggregate, and all fat or bleeding surfaces shall be covered with approved cover material in such manner that the asphaltic material will not adhere to or be picked up on the wheels of vehicles.

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

The temperature of application shall be within the limits recommended in City Standard Specification Section 025404 "Asphalts, Oil and Emulsions", with that being 220 to 300 degrees F for AC-3, and 275 to 350 degrees F for AC-5.

4. MEASUREMENT AND PAYMENT

Unless otherwise indicated in the Bid Form, seal coat will be measured by the square yard in place to the limits shown on the plans and as directed by the Engineer. Payment shall be full compensation for cleaning and sprinkling the existing surface; for furnishing, preparing, hauling and placing all materials; for all freight involved; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

END OF SECTION

SECTION 025424
HOT MIX ASPHALTIC CONCRETE PAVEMENT (Class A) TYPE D

1. DESCRIPTION

This specification shall govern all work required for furnishing and laying Hot Mix Asphalt Concrete (HMAC) surface, binder and base courses required to complete the project.

2. MATERIALS

2.1. Aggregate. The aggregate shall consist of a blend of course aggregate, fine aggregate and, if required, a mineral filler.

2.1.1. Coarse Aggregate shall consist of that fraction of aggregate retained on a No. 10 sieve and shall consist of crushed furnace slag, crushed stone, or crushed gravel.

Deleterious material in course aggregate shall not exceed 2% per TxDOT Test Method TEX-217-F.

Course aggregate shall be crushed such that a minimum of 85% of the particles have more than one crushed face, unless noted otherwise on the plans.

Los Angeles abrasion losses for course aggregate shall not exceed 40% by weight for the surface course and 45% for the binder and base courses per TxDOT Test Method TEX-410-A.

Polish Value not less than 30 for aggregate used in the surface course per TxDOT Test Method TEX-438-A.

2.1.2. Fine Aggregate is defined as the fraction passing a No. 10 sieve and shall be of uniform quality.

Fine aggregate shall consist of screenings of material that pass the Los Angeles abrasion requirements in paragraph 2.1.1 above. Screenings shall be blended with a maximum of 15% uncrushed aggregate or field sand for Type D mixes, or a maximum of 10% uncrushed aggregate or field sand for Type A, B, and C mixes.

Grading of fine aggregate shall be as follows:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
No. 10	100
No. 200	0-15

2.1.3 Filler shall consist of dry stone dust, Portland cement, hydrated lime, or other mineral dust approved by the Engineer.

Grading of filler shall be as follows:

<u>Sieve Size</u>	<u>Minimum Percent Passing by Weight</u>
No. 30	95
No. 80	75
No. 200	55

2.2. Reclaimed Asphalt Pavement (RAP). Reclaimed asphalt pavement may be incorporated into the hot mix asphalt concrete furnished for the project, provided that the mixture is designed per the TxDOT Methods and meets the applicable provisions of said TxDOT Item 340 and this specification.

2.3. Asphalt. Asphalt Material shall be in accordance with Standard Specification Section 025404 "Asphalt, Oils and Emulsions" and AASHTO.

2.3.1. Paving Mixture:

<u>APPLICATION</u>	<u>ASPHALT GRADE</u>
Residential or low volume	PG 64-22
Collector	
Surface Course	PG 70-22
Binder Course	PG 64-22
Arterial	
Surface Course	PG 76-22
Binder Course	PG 64-22
Base Courses	PG 64-22

2.3.2. Tack Coat shall consist of an emulsion, SS-1 diluted with equal volume of water and applied at a rate ranging from 0.05 to 0.15 gallon per square yard.

3. PAVING MIXTURE

3.1. Mix Design. The mixture shall be designed in accordance with TxDOT Bulletin C-14 and TxDOT Test Method TEX-204-F to conform to the requirements of this specification. The Contractor shall furnish the mix design for the job-mix to be used for the project, unless shown otherwise on the drawings. The mix design shall be submitted prior to placement of the mixture.

The design procedures are intended to result at a job-mix with properties in compliance with these specifications, and when properly placed the job-mix will be durable and stable. The sieve analysis of the job-mix shall be within the range of the Master Gradation and Tolerances specified herein. The job-mix shall meet the density and stability requirements as specified and shall be included with the mix design as submitted per above.

If the specific gravity of any of the types of aggregates differs by more than 0.3, use volume method.

Plot sieve analysis of job-mix; percent passing versus size on four-cycle semi-log paper or other appropriate type paper. Show tolerance limits and Limits of Master Gradation.

3.2. Master Gradation of Aggregate. The aggregate for the type of mix specified shall be within the following tabulated limits per TxDOT Test Method TEX-200-F (Dry Sieve Analysis):

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

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

3.3. Tolerances. The mixture delivered to the job site shall not vary from the job-mix by more than the tolerances specified below. The gradation of the produced mix shall not fall outside the Master Grading Limits, with the following exceptions: for Type B material coarser than 3/8" and for Type D material coarser than #4. Variations from job-mix shall not exceed the following limits, except as noted above:

<u>Item:</u>	<u>Tolerances Percent by Weight or Volume</u>
1" to No. 10	Plus or Minus 5.0
No. 40 to No. 200	Plus or Minus 3.0
Asphalt Weight	Plus or Minus 0.5
Asphalt Volume	Plus or Minus 1.2

3.4. Mix Properties. The mixture shall have a minimum Hveem stability of 40 for Type A, B, and C mixes, and 35 for Type D mixes per TxDOT Test Method TEX-208-F at an optimum density of 96% (plus or minus 1.5) of theoretical maximum density per TxDOT Test Methods TEX-227-F and TEX-207-F.

3.5. Sampling and Testing of Raw Materials. The Contractor shall sample materials as necessary to produce a mix in compliance with these specifications.

4. EQUIPMENT

4.1. Mixing Plants. Mixing plants shall be either the weigh batching type or the drum mix type. Both types shall be equipped with satisfactory conveyors, power units, aggregate handling equipment, aggregate screens and bins (weigh batch only), and pollution control devices as required.

4.2. Truck Scales. A set of truck scales, if needed for measurement, shall be placed at a location approved by the Engineer.

4.3. Asphalt Material Heating Equipment. Asphalt material heating equipment shall be adequate to heat the required amount of material to the desired temperature. Agitation with steam or air will not be permitted. The heating apparatus shall be equipped with a recording thermometer with a 24-hour continuous chart that will record the temperature of the asphalt at the highest temperature.

4.4. Surge-Storage System. A surge-storage system may be used provided that the mixture coming out of the bins is of equal quality to that coming out of the mixer. The system shall be equipped with a gob hopper, rotating chute or other devices designed to minimize segregation of the asphalt mixture.

4.5. Laydown Machine. The laydown machine shall be capable of producing a surface that will meet the requirements of the typical cross section, of adequate power to propel the delivery vehicles, and produce the surface tolerances herein required. It shall be wide enough to lay a 28-foot street (back-to-back of curbs) in a maximum of two passes.

4.6. Rollers. All rollers shall be self-propelled and of any type capable of obtaining the required density. Rollers shall be in satisfactory operating condition and free from fuel, hydraulic fluid, or any other fluid leaks.

5. STORAGE, PROPORTIONING AND MIXING

5.1. Storage and Heating of Asphalt Materials. Asphalt cement shall not be heated to a temperature in excess of that recommended by the producer. Asphalt storage equipment shall be maintained in a clean condition and operated in such a manner that there will be no contamination with foreign matter.

5.2. Feeding and Drying of Aggregates. The feeding of various sizes of aggregate to the dryer shall be done in such a manner that a uniform and constant flow of materials in the required proportions will be maintained. In no case shall the aggregate be introduced into the mixing unit at a temperature more than 350 degrees F.

5.3. Proportioning. All materials shall be handled and proportioned in a manner that yield an acceptable mixture as herein specified and as defined by the job-mix.

5.4. Mixing.

5.4.1. Weigh Batch Plant. In charging the weigh box and in charging the pugmill from the weigh box, such methods or devices shall be used as necessary to minimize segregation of the mixture.

5.4.2. Drum Mix Plant. The amount of aggregate and asphalt cement entering the mixer and the rate of travel through the mixer shall be coordinated so that a uniform mixture of the desired gradation and asphalt content will be produced.

5.4.3. The mixture produced from each type of plant shall not vary from the job-mix by more than the tolerances and restrictions herein specified. The mixture when discharged from the plant shall have a moisture content not greater than one percent by weight of total mix when determined by TxDOT Test Method TEX-212-F.

5.4.4. The mixture produced from each type of plant shall be at a temperature between 250 and 325 degrees F. After a target mixing temperature has been established, the mixture when discharged from the mixer shall not vary from this temperature by more than 25 degrees F.

6. CONSTRUCTION METHODS

6.1. Construction Conditions. For mat thicknesses greater than 1.5 inches, the asphalt material may be placed with a laydown machine when the air temperature is 40 degrees F and rising but not when the air temperature is 50 degrees F and falling. In addition, mat thickness less than and including 1.5 inches shall not be placed when the temperature of the surface on which the mat is placed is below 50 degrees F.

6.2. Prime Coat. If a prime coat is required, it shall be applied and paid for as a separate item conforming to the requirements of Standard Specification Section 025412 "Prime Coat", except the application temperature shall be as provided above. The tack coat or asphaltic concrete shall not be applied on a previously primed flexible base until the primed base has completely cured to the satisfaction of the Engineer.

6.3. Tack Coat. Before the asphalt mixture is laid, the surface upon which the tack coat is to be placed shall be thoroughly cleaned to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using materials and rates herein specified and/or as shown on the plans. The tack coat shall be rolled with a pneumatic tire roller as necessary.

6.4. Transporting Asphalt Concrete. The asphalt mixture shall be hauled to the job site in tight vehicles previously cleaned of all foreign matter. In cool weather or for long hauls, canvas covers and insulated truck beds may be necessary. The inside of the bed may be given a light coating of lime water or other suitable release agent necessary to prevent from adhering. Diesel oil is not allowed.

6.5. Placing. The asphalt mixture shall be spread on the approved prepared surface with a laydown machine or other approved equipment in such a manner that when properly compacted, the finished surface will be smooth and of uniform density, and meet the requirements of the typical cross section as shown on the plans.

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

6.5.2. Construction joints of successive courses of asphaltic material shall be offset at least six inches. Construction joints on surface courses shall coincide with lane lines, or as directed by the Engineer.

6.6. Compacting. The asphalt mixture shall be compacted thoroughly and uniformly with the necessary rollers to obtain the required density and surface tolerances herein described and any requirements as shown on the plans. Regardless of the method of compaction control followed, all rolling shall be completed before the mixture temperature drops below 175 degrees F.

6.7. In-Place Density. In-place density control is required for all mixtures except for thin, irregular level-up courses. Material should be compacted to between 96% and 92% of maximum theoretical density or between 4% and 8% air voids. Average density shall be greater than 92% and no individual determination shall be lower than 90%. Testing shall be in accordance with TxDOT Test Methods TEX-207-F and TEX-227-F.

Pavement specimens, which shall be either cores or sections of the compacted mixture, will be tested as required to determine the percent air voids. Other methods, such as nuclear determination of in-place density, which correlate satisfactorily with actual project specimens may be used when approved by the Engineer.

6.8. Thickness. The total compacted average thickness of the combined HMAC courses shall not be less than the amount specified on the drawings. No more than 10% of the measured thickness(es) shall be more than 1/4 inch less than the plan thickness(es). If so, the quantity for pay shall be decreased as deemed appropriate by the Engineer.

6.9. Surface Smoothness Criteria and Tests. The pavement surface after compaction, shall be smooth and true to the established lines, grade and cross-section. The surface shall be tested by

the Owner with the Mays Roughness Meter. The Mays Roughness Value for each 600-foot section shall not exceed ninety inches per mile per traffic lane.

Localized defects (obvious settlements, humps, ridges, etc.) shall be tested with a ten-foot straightedge placed parallel to the roadway centerline. The maximum deviation shall not exceed 1/8 inch in ten feet. Areas not meeting this criterion shall be corrected to the satisfaction of the Engineer.

6.10. Opening to Traffic. The pavement shall be opened to traffic when directed by the Engineer. The Contractor's attention is directed to the fact that all construction traffic allowed on pavement open to the public will be subject to the State laws governing traffic on highways.

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

7. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 025608
INLETS

1. DESCRIPTION

This specification shall govern for the construction of inlets complete in place and the materials used therein, including the installation, and the furnishing of frames, grates, rings and covers.

2. TYPES

The various types of inlets are designated on the drawings by letters or by numbers indicating the particular design of each. Each type shall be constructed in accordance with the details shown on the drawings and to the depth required by the profiles and schedules given.

3. MATERIALS

- (1) Concrete. Concrete for curb inlets shall be Class "A" concrete conforming to the requirements of Specification Section 038000 "Concrete Structures", and City Standard Specification Section 030020 "Portland Cement Concrete", except as otherwise provided on the drawings. Concrete for grate inlets, drop inlets and post inlets shall be Class "C" concrete in accordance with City Standard Specification Section 030020 "Portland Cement Concrete".
- (2) Mortar. Mortar shall be composed of one part Portland cement and two parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions of Specification Section 030020 "Portland Cement Concrete" for fine aggregate. Hydrated lime or lime putty may be added to the mix but in no case shall it exceed 10 percent by weight of the total dry mix.
- (3) Reinforcing Steel. Reinforcing Steel shall conform to the requirements of Specification Section 032020 "Reinforcing Steel".
- (4) Concrete Blocks. Concrete blocks, when shown on the drawings, shall conform to the requirements of ASTM C 139.
- (5) Frames, Grates, Rings and Covers. Frames, grates, rings and covers shall conform to the requirements of City Standard Specification Section 055420 "Frames, Grates, Rings and Covers".
- (6) Cast Iron. Cast iron for supports and inlet units shall conform to the shape and dimensions shown on the plans. The castings shall be clean and perfect, free from sand or blow holes or other defects. Cast iron castings shall conform to the requirements of "Gray Iron Castings" ASTM A 48, Class 30.

4. CONSTRUCTION METHODS

- (1) General. All concrete work shall be performed in accordance with the requirements of Specification Section 038000 "Concrete Structures", unless otherwise specified.

Forms will be required for all concrete walls, except where the nature of the surrounding material is such that it can be trimmed to a smooth vertical face.

- (2) Inlets for Precast Concrete Pipe Sewers. The construction of inlets for precast concrete pipe sewers shall be done as soon as is practicable after sewer lines into or through inlet locations are completed. All sewers shall be cut neatly at the inside face of the walls of inlet and pointed up with mortar. Subgrade under cast-in-place and precast inlets shall be compacted to not less than 95% Standard Proctor density.
- (3) Inverts. The inverts passing out or through the inlet shall be shaped and routed across the floor of inlet as shown on the plans. This shaping may be accomplished by adding and shaping mortar or concrete after the base is cast or by placing the required additional material with the base.
- (4) Finishing Complete Inlets. Inlets shall be completed in accordance with the drawings. Backfilling to finish grade elevation with native material, free of debris and compacted to over 95% Standard Proctor density. Backfilling shall be in accordance with the provisions of City Standard Specification Section 022020 "Excavation and Backfill for Utilities".

5. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, inlets shall be measured as individual units by each inlet, complete in place.

Extension to inlets will be measured by each extension separately from the inlet.

Excavation, backfill, frames, grates, rings and covers will be considered subsidiary to the construction of the inlets.

Payments shall be full compensation for furnishing all concrete, reinforcing steel, mortar, castings, frames, grates, rings and covers, and for all other materials, labor, tools, equipment and incidentals required to perform the work prescribed above.

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 025610
CONCRETE CURB AND GUTTER

1. DESCRIPTION

This specification shall consist of Portland cement concrete combined concrete curb and gutter or separate concrete curb with or without reinforcing steel as required, constructed on an approved subgrade or foundation material in accordance with these specifications, in conformity with the lines and grades established by the Engineer and details shown on the plans.

2. MATERIALS

Unless otherwise specified on the plans, materials and proportions for concrete used in construction under this specification shall conform the requirements as specified for Class "A" Concrete under specification Section 030020 "Portland Cement Concrete". Reinforcing steel, if required, shall conform to the requirements as specified in specification Section 032020 "Reinforcing Steel". Expansion joint filler shall be wood fiber asphalt-impregnated expansion board material.

3. CONSTRUCTION METHODS

The foundation shall be excavated and shaped to line, grade and cross-section and, if considered necessary in the opinion of the Engineer, hand tamped and sprinkled. If dry, the subgrade or foundation material shall be sprinkled lightly with water immediately before concrete is deposited thereon.

Outside forms shall be of wood or metal, of a section satisfactory to the Engineer, straight, free of warp, and a depth equal to the depth of the curb and gutter. They shall be securely staked to line and grade, and maintained in a true position during the depositing of concrete. Inside forms for the curb shall be approved material, shall be of such design as to provide the curb required, and shall be rigidly attached to the outside forms. Where specifically permitted by the Engineer in writing, the Contractor may place concrete curb and gutter with an extrusion machine.

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

Concrete for curb and gutter shall be mixed in a manner satisfactory to the Engineer. The curb and gutter shall be placed in sections of the length indicated on the plans, and each section shall be separated by a premolded insert or board joint of cross-section specified for the curb and gutter, and of the thickness indicated on the plans.

After the concrete has been struck off and after it has become sufficiently set, the exposed surfaces shall be thoroughly worked with a wooden float. The exposed edges shall be rounded by the use of an edging tool to the radius indicated on the plans. All exposed surfaces of curb and gutter, or curb, shall be brushed to a smooth and uniform surface.

The completed curb and gutter shall be cured with Type 2, white pigmented, curing compound unless shown otherwise on the plans. Other methods of curing as outlined in specification Section 038000 "Concrete Structures" will be acceptable with a required curing period of 72 hours.

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

4. MEASUREMENT AND PAYMENT

Payment shall be full compensation for all labor, equipment, tools and incidentals necessary for the work prescribed in this specification and payment will be part of the project lump sum bid.

END OF SECTION

SECTION 025612
CONCRETE SIDEWALKS AND DRIVEWAYS

1. DESCRIPTION

The specification shall consist of sidewalks and driveways, with or without reinforcing steel, composed of Portland cement concrete, constructed as herein specified on an approved subgrade, in conformity with the lines and grades established by the Engineer and the details shown on the plans.

2. MATERIALS

Materials and proportions used in construction under this item shall conform to the requirements as specified for Class "A" concrete under specification Section 030020 "Portland Cement Concrete". Reinforcing steel, if required, shall conform to the requirements as specified in specification Section 032020 "Reinforcing Steel". Expansion joint filler shall be premolded material meeting the requirements specified in specification Section 038000 "Concrete Structures". Cap seal shall be "Greenstreak" or approved equal.

3. CONSTRUCTION METHODS

The subgrade shall be excavated, compacted and shaped to line, grade and cross-section and, if considered necessary in the opinion of the Engineer, hand tamped and sprinkled with water. The subgrade shall be moist at the time the concrete is placed.

Forms shall be of wood or metal, of a section satisfactory to the Engineer, straight, free from warp, and of a depth equal to the thickness of the finished work. They shall be securely staked to line and grade and maintained in a true position during the depositing of concrete.

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

Sidewalks shall be constructed in sections of the lengths shown on plans. Unless otherwise provided by the plans, no section shall be a length less than 8 feet and any section less than 8 feet shall be removed by the Contractor at his own expense.

The different sections shall be separated by a premolded insert of the thickness shown on the plans, placed vertically and at right angles to the longitudinal axis of the sidewalks. Where the sidewalk or driveways abut a curb or retaining wall, approved expansion joint material shall be placed along their entire length. Similar expansion joint material shall be placed around all obstructions protruding through sidewalks or driveways.

Concrete shall be mixed in a manner satisfactory to the Engineer, placed in the forms to the depth specified and spaded and tamped until thoroughly compacted and mortar entirely covers the surface. The top surface shall be floated with a wooden float to a gritty texture. The outer edges and joints shall then be rounded with approved tools to the radii shown on plans.

Sidewalks shall be marked into separate sections, each 4 feet in length, by the use of approved jointing tools.

When completed, the sidewalks and driveways shall be cured with Type 2, white pigmented curing compound. Other methods of curing as outlined in specification Section 038000 "Concrete Structures" will be acceptable with a required curing period of 72 hours.

4. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 025614
CONCRETE CURB RAMPS

1. DESCRIPTION

This specification shall govern all work necessary for constructing Concrete Curb Ramps required to complete the project.

2. MATERIALS

Concrete shall be class "A" in accordance with Section 030020 of the Standard Specifications.

Unless shown otherwise on the Drawings, reinforcement shall be 4x4 - W2.9 welded wire fabric in accordance with Section 032020 of the Standard Specifications.

3. CONSTRUCTION METHODS

The subgrade shall be shaped to line, grade, cross section, and shall be of uniform density and moisture, when concrete is placed. The subgrade shall be hand tamped and sprinkled to achieve the desired consistency and uniform support.

Ramps shall be constructed of Class A concrete to line and section as shown on the plans. Unless shown otherwise on the Drawings, ramps shall have a minimum concrete thickness in excess of 4", prior to application of exposed aggregate surface texture.

Slopes, S, shall be as follows unless shown otherwise on the Drawings:

RAMPS

Ramp in direction of travel	$S \leq 1:12$
Side slope of ramp (flare)	$S \leq 1:10$
Cross Slope	$1:100 \leq S \leq 1:50$

ADJOINING AREAS

Landings adjacent to ramp	$S \leq 1:20$
Driveways abutting tied sidewalk	$S \leq 1:10$

Width of ramp shall be 36", exclusive of flare, unless shown otherwise in the Drawings. No ramp shall be less than 36" wide.

Obstructions shall be removed or relocated, as appropriate, or the location of the ramp may be shifted, if authorized.

Surfacing shall be the little domes. Surfacing shall be flush with abutting areas. Surfacing shall be subsidiary work and not be measured for separate pay. Abutting curbs, sidewalks, gutters, driveways, etc. shall not receive granite surfacing.

Pavement Markings for street crossings shall be placed such that the crosswalk is properly aligned with respect to the curb ramp. See striping details for proper alignment of striping with respect to intersection and curb ramp. Properly constructed curb ramp shall be true to line, section, and grade and shall be free of loose granite surfacing and irregularities.

4. MEASUREMENT AND PAYMENT

Measurement and payment shall be as stated in the Special Provisions and/or as indicated in the bid forms.

END OF SECTION

SECTION 025802
TEMPORARY TRAFFIC CONTROLS DURING CONSTRUCTION

1. DESCRIPTION

This specification shall govern all work required for Temporary Traffic Controls During Construction. The work shall include furnishing, installing, moving, replacing, and maintaining all temporary traffic controls including, but not limited to, barricades, signs, barriers, cones, lights, signals, temporary striping and markers, flagmen, and such temporary devices as necessary to safely complete the project.

2. MATERIALS

Traffic control devices shall conform to the Texas Manual on Uniform Traffic Control Devices (latest edition), unless indicated otherwise on the Traffic Control Plan.

3. METHODS

Sufficient traffic control measures shall be used to assure a safe condition and to provide a minimum of inconvenience to motorists and pedestrians.

A Traffic Control Plan (TCP) is included in the drawings.

A competent person, responsible for implementation of the TCP, maintaining the temporary traffic control devices and for traffic safety during construction, shall be designated by the Contractor.

The name and off-hours phone number of the competent person shall be provided in writing at the Pre-Construction Conference.

The competent person shall be on site, during working hours and on call at all times in the event of off-hour emergency.

4. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 026202
HYDROSTATIC TESTING OF PRESSURE SYSTEM

1. DESCRIPTION

This specification shall govern all work necessary for hydrostatically testing the completed pressure system. The Contractor shall provide all equipment, materials, labor, etc., as necessary, except as noted, and accomplish all testing under this specification.

2. MATERIALS

Water for filling the line and making tests will be furnished by the Contractor through a standard meter connection. A meter and gauges for testing will be supplied by the Contractor. A test pump with appropriate connector points as approved by the Water Superintendent for the installation of meter and gauge shall be furnished by the Contractor. The meter shall be directly connected to the main or pipe being tested by the use of copper tubing or an approved reinforced hose. The meter shall be protected against extreme pressures by the use of a one inch (1") safety relief valve set at the test pressure plus ten pounds per square inch and furnished by the Contractor.

3. TEST PROCEDURE

Tests shall be made only after completion of backfill as specified, and not until at least thirty-six (36) hours after the last concrete thrust block has been cast with high early strength concrete, or seven (7) days with standard concrete.

Each section of pipe line shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied. During the filling of the pipe, and before applying the specified test pressure, all air shall be expelled from the pipe line.

During the test, all exposed pipe, fittings, valves, hydrants, and joints shall be carefully examined. If found to be leaking, they shall be corrected immediately by the Contractor. If the leaking is due to cracked or defective material, the defective material shall be removed and replaced by the Contractor with sound material.

All pipe shall be subjected to two hydrostatic tests. The first hydrostatic test shall be a two hour test at a pressure of 150 P.S.I. The second test shall be no less than 48 hours after successful completion of the first hydrostatic test. The second hydrostatic test shall be for a 24 hour period at Owner operating pressure for waterlines or at 50 P.S.I. for sanitary sewer force mains.

The maximum allowable leakage shall be as follows:

Ductile Iron Pipe, AWWA C600

$$L = \frac{SD(P)^{1/2}}{133,200} \quad \text{or} \quad L = \frac{ND(P)^{1/2}}{7,400}$$

Asbestos - Cement Pipe, AWWA C603

$$L = \frac{N D(P)^{1/2}}{4,000}$$

PVC Pipe - Uni-bell equation 99

$$L = \frac{N D(P)^{1/2}}{7,400}$$

WHERE

L = Maximum Allowable Leakage (Gal./Hr.)

S = Length of Pipe Tested (Feet)

N = Number of Joints in Tested Line (Pipe & Fittings)

D = Nominal Diameter of Pipe (In.)

P = Average Test Pressure (P.S.I.)

If the pressure system fails to meet the leakage requirements, the Contractor shall make the required repairs to the system and the system shall be retested. This procedure shall be repeated until the system complies with leakage requirements. The cost of each retest shall be \$100.

4. MEASUREMENT & PAYMENT

~~There shall be no separate pay item for the testing of pressure pipe. This activity shall be considered subsidiary to the items where Hydrostatic Testing is required.~~ This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 026210
POLYVINYL CHLORIDE PIPE
(AWWA C900 & C905 Pressure Pipe for Municipal Water Mains and
Sanitary Sewer Force Mains)

1. DESCRIPTION

This specification shall govern all work necessary for furnishing all PVC pipe (AWWA C900 and C905) required to complete the project.

2. MATERIAL

PVC pipe shall be made of Class 12454-A or Class 1245-B virgin compounds, as defined in ASTM D1784 with an established hydrostatic-design-basis of 4000 psi for water at 73.4° F.

3. DIMENSIONS

Pipe shall be manufactured to cast iron pipe equivalent outside diameters.

4. JOINT

Pipe shall have a gasket bell end with a thickened wall section integral with the pipe barrel. The use of solvent weld pipe shall not be allowed.

5. GASKETS

Gaskets for jointing pipe shall be in accordance with ASTM F477. (High Head)

6. PIPE PRESSURE CLASS AND DIMENSION RATION

Unless indicated otherwise on the drawings pipe shall have a dimension ratio (DR) of 18 and in accordance with:

<u>Pipe Size</u>	<u>Designation</u>
4" to 12"	AWWA C900
Over 12"	AWWA C905

7. CAUSE FOR REJECTION

Pipe shall be clearly marked in accordance with AWWA Requirements. Unmarked or scratched pipe shall be rejected.

8. CERTIFICATION

The contractor shall furnish in duplicate to the Engineer a copy of the manufacturer's affidavit of compliance with this specification, to include gaskets. Certification shall accompany each delivery of materials.

9. MEASUREMENT AND PAYMENT

~~Unless specified otherwise in the plans and specifications, PVC pipe (AWWA C900 or C905) will be measured by the linear foot along the centerline for each size installed. Measurement of pipe shall be up to, but not include, the fittings.~~

~~Payment shall include all labor, materials, and equipment for the completed installation and testing of the water and/or force main system together with all incidentals necessary to install the pipe complete in place, will be part of the project lump sum bid or as indicated on the bid documents.~~

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 026212
MOLECULARLY ORIENTED POLYVINYL CHLORIDE PIPE (MOP)
(AWWA C909 Pressure Pipe for Municipal Water Mains and Sanitary Sewer Force Mains)

1. DESCRIPTION

This specification shall govern all work necessary for furnishing all MOP pipe (AWWA C909) required to complete the project.

2. MATERIAL

MOP pipe shall be made of Class 12454-A or Class 1245-B virgin compounds, as defined in ASTM D1784 with an established hydrostatic-design-basis of 7100 psi for water at 73.4 F.

3. DIMENSIONS

Pipe shall be manufactured to cast iron pipe equivalent outside diameters.

4. JOINT

Pipe shall have a gasket bell end with a thickened wall section integral with the pipe barrel. The use of solvent weld pipe shall not be allowed.

5. GASKETS

Gaskets for jointing pipe shall be in accordance with ASTM F477. (High Head)

6. PIPE PRESSURE CLASS

Unless indicated otherwise on the drawings pipe shall be Class 150.

7. CAUSE FOR REJECTION

Pipe shall be clearly marked in accordance with AWWA Requirements. Unmarked or scratched pipe shall be rejected.

8. CERTIFICATION

The contractor shall furnish in duplicate to the Engineer a copy of the manufacturer's affidavit of compliance with this specification, to include gaskets. Certification shall accompany each delivery of materials.

9. MEASUREMENT AND PAYMENT

Unless indicated otherwise in the Proposal, MOP pipe (AWWA C909) shall not be measured for pay but shall be subsidiary to the appropriate bid item, waterline, sanitary force main, etc.

END OF SECTION

SECTION 026402
INSTALLATION OF WATER PIPE

1. DESCRIPTION

This specification, in conjunction with the Owner and Water District Standards, shall govern all work necessary for the installation of all waterline facilities required to complete the project.

2. MATERIALS

Concrete: Concrete shall have a minimum compressive strength of 2000 PSI.

Bedding Sand for Encasement: Sand shall be granular soil of low plasticity such that 100% pass a #4 sieve and no more than 10% pass a #200 sieve and the PI shall not exceed 10. Soils with a Unified Classification of SW and SP, or AASHTO Classification of A3, and some A2 soils shall be required.

Ductile Iron Pipe and Fittings: See Standard Specification Section 026206.

~~**Cast Iron Pipe and Fittings:** See Standard Specification Section 26208.~~

Polyvinyl Chloride Pipe: See Standard Specification Section 026210.

Tapping Sleeves and Valves: See Standard Specification Section 026409.

Gate Valves for Waterlines: See Standard Specification Section 026411.

Fire Hydrants: See Standard Specification Section 026416.

3. CONSTRUCTION METHODS

(1) **HANDLING MATERIALS**

- a) General: The Contractor shall be responsible for the safe storage of all material furnished to, or by him, and accepted by him, until it has been incorporated in the completed project.

All material found during the progress of the work to have cracks, flaws or other defects will be rejected, and the Contractor shall remove such defective material from the site of the work.

- b) Unloading and Distribution of Materials at Work Site: Pipe and other materials shall be unloaded at point of delivery, hauled to and distributed at the job site by the Contractor. Materials shall at all times be handled with care and in accordance with manufacturer's recommendations. Care shall be taken not to scratch PVC pipe. Excessive scratching shall be considered cause for rejection of PVC pipe. Materials may be unloaded opposite or near the place where it is to be installed provided that it is to be incorporated into the work within 10 days. The Contractor shall not distribute material in such a manner as to cause undue inconvenience to the public.
- c) Storing Materials: Materials that are not to be incorporated into the work within 10 days shall be stored on platforms. The interior of pipes and accessories shall be kept free from dirt and foreign matter.

(2) **ALIGNMENT AND GRADE**

- a) General: All pipes shall be laid and maintained to the required lines and grades. Fittings, valves and hydrants shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb.

Temporary support and adequate protection of all underground and surface utility structures encountered in the progress of the work shall be furnished by the Contractor.

Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, connections to sewers or drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the Contractor at the Contractor's expense, in cooperation with the owners of such utility structures.

- b) Deviation from Drawings: No deviation from the line and grade shown on plans may be made without the written consent of the Engineer.
- c) Depth of Cover: Depth of cover will be measured from the established street grade or the surface of the permanent improvement, or from finished grade to the top of the pipe barrel. Unless otherwise shown on drawings, the minimum depth of cover shall be 36 inches.

(3) **TRENCH EXCAVATION AND BACKFILL**

See Standard Specification Section 022020, Excavation and Backfill for Utilities and Sewers.

(4) **POLYETHYLENE WRAPPING**

All ductile or cast iron pipe, valves and fittings, except pipe or valves which are laid in encasement pipe or in concrete valve boxes, shall be wrapped in polyethylene. The polyethylene material shall have a thickness of 8 mils and may be either clear or black. The wrapping shall be lapped in such manner that all surfaces of pipe valves and fittings, including joints, shall have a double thickness of polyethylene. If a single longitudinal lap is made, using a double thickness of polyethylene, it shall be lapped a minimum of 18 inches and the lap shall be placed in the lower quadrant of the pipe and in such a manner that backfill material cannot fall into the lap. The polyethylene shall be secured in place with binder twine at not more than 6-foot intervals. If wrapping is applied before the pipe is placed in the trench, then special care shall be taken in handling the pipe so that the wrapping will not be damaged. Care shall also be exercised in backfilling around the pipe and fittings and in blocking fittings so as not to damage the wrapping. Any wrapping that may be damaged shall be repaired in a manner satisfactory to the Engineer and so as to form the best protection to the pipes.

(5) **SAND ENCASEMENT**

All pipe and fittings which are not enclosed in concrete valve boxes, or laid in encasement pipe, shall be completely encased with a minimum of eight inches of sand. This encasement includes the bottom, sides and top of pipe and fittings including bells, so that all portions will be encased with a minimum of eight inches of sand to insulate the pipe from the natural ground and from the backfill. The sand shall be compacted to a minimum of 90% Standard Proctor.

Sand shall be placed in a manner that will not injure the polyethylene wrapping and shall be

compacted under, around the side, and over the pipe in a manner that will reduce settlement to a minimum and as approved by the Engineer.

In order to reduce the amount of sand required, the trench bottom may be excavated in a rounded manner so as to maintain at least a minimum of eight inches of sand between the excavation and the pipe.

(6) **LOWERING PIPE AND ACCESSORIES IN THE TRENCH**

- a) General: The trench shall be excavated true and parallel to the pipe center line with a minimum clearance of eight inches below the pipe bottom and with a like clearance from the bottom of the bell to the bottom of the bell hole. The trench will then be refilled to the proper grade with sand as specified. The placing of the encasing material shall be done in such a manner so as to be free of all natural soil rock or other foreign matter.

After final grading in the trench of the encasing material, bell holes shall be excavated at each joint.

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe, fittings, valves, hydrants and accessories shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable equipment, in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

- b) Inspection of Pipe and Accessories: The pipe and accessories shall be inspected for defects prior to lowering in the trench. Any defective damage or unsound pipe shall be replaced.
- c) Clean Pipe: All foreign matter, or dirt, shall be removed from the interior of the pipe prior to lowering into the trench. Pipe shall be kept clean both in and out of the trench at all times during the laying.

(7) **JOINTING PIPES**

All pipes shall be made up in accordance with manufacturer's recommendation. Pipe deflection shall not exceed 75% of the maximum amount recommended by the manufacturer.

(8) **CONCRETE THRUST BLOCKS**

Thrust backings shall be applied at all bends, tees, incomplete crosses and blow-offs, except at anchored fittings. The size and shape of the thrust blocking shall be as shown on the plans. Materials for the backings shall be minimum 2,000 psi concrete and shall be placed between solid ground and the fittings to be anchored. The sizes of thrust blocking is indicated on the drawings.

The backing shall be placed so that the pipe and fitting joints will be accessible for repair.

Temporary thrust blocks, or other means of carrying thrust loads generated by hydrostatic testing shall be provided at all ends of lines to be tested. Details of the end connections and method of temporary blocking shall be submitted to the Engineer for approval. After satisfactory completion of the hydrostatic test, this temporary blocking shall be removed so that connections may be made with existing lines. This work is subsidiary to waterline installation and no separate payment

will be made for it.

(9) **METAL HARNESS**

Metal harness, tie rods and clamps, or swivel fittings shall be used to prevent movement when soil conditions will not withstand thrust blocking. Steel rods and clamps shall be galvanized, or otherwise rust proofed or coated with hot coal tar enamel, then wrapped with two layers of polyethylene wrapping.

(10) **STERILIZATION**

- a) Fittings: Valves, hydrants and fittings shall be stored on timbers and kept clean. Where soil or other substance has come in contact with the water surfaces of the fittings, the interior shall be washed and sterilized with 2% solution of calcium hypochlorite.
- b) Pipe: As each joint of pipe is laid, the Contractor, unless otherwise specified by the Engineer, shall throw powdered calcium hypochlorite (70%) through the length of the joint (One pound for each 1,680 gallons of water to give 50 ppm). When the line is complete, and before testing, same shall be slowly filled with water between valves and allowed to stand for 48 hours. After sterilization period is completed, lines shall be flushed by the Contractor under the direct supervision of a representative of the Owner Water Department. The Engineer will take same test two hours after refilling. If the sample does not pass State Health Department purification standards, the procedure shall be repeated. The entire procedure shall be coordinated under the supervision of the Water Division Superintendent/Engineer.

During sterilization process, valves shall be operated only under the supervision of the Water Division Superintendent/Engineer. There shall be a base fee of \$100 paid by the Contractor to the Owner for each retest that is required.

(11) **HYDROSTATIC TESTING WATER SYSTEM**

See Standard Specification Section 026202, Hydrostatic Testing of Pressure System.

(12) **WATER SERVICE CONNECTIONS**

See Standard Specification Section 026404, Water Service Lines.

4. MEASUREMENT AND PAYMENT

~~Unless specified otherwise in the Special Provisions, installation of water pipe will not be measured and is considered subsidiary to payment for the pipe.~~ This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 026404
WATER SERVICE LINES

1. DESCRIPTION

This specification shall govern all work necessary for furnishing and installing water service lines required to complete the project. Water Service lines are those lines from the Owner main to the meter at the property line.

2. MATERIALS

GENERAL

Service fittings shall have a minimum of 150 psi working pressure rating, unless indicated otherwise.

Fittings and materials shall be in accordance with the applicable provisions of AWWA C-800.

All service connections shall require service clamps.

SERVICE CLAMP

Service clamps shall be brass saddle with two silicone bronze straps with I.P. thread and have a minimum working pressure rating of 200 psi. The saddle and nuts shall be of 85-5-5-5 brass alloy per ASTM B-62 and AWWA C800. The Nuts shall have unitized washers. Straps shall be 5/8" high quality silicone bronze flattened and contoured to provide a wider bearing surface against pipe. Clamps shall be comparable to:

Ford 202B, Smith Blair 323, Rockwell 323

CORPORATION STOP

Corporation Stop shall be of brass with I.P. thread inlet and Muller 110 Compression connection outlet designed for type K copper pipe and be comparable in design to the following:

Muller H-15028 for 3/4" & 1" sizes

Muller H-15023 for 1 1/2" & 2" sizes

ANGLE METER STOP

Angle Meter Stop shall have a Teflon coated bronze ball which rotates within two Buna-N rubber seats. Inlet shall be packed joint for Type K copper and be comparable in design to the following:

For BA43-332 for 3/4" & BA43-444 for 1"

Brass gate valve req. for 1 1/2" and 2" sizes

SERVICE LINE

Service line shall be of type K copper tube.

Other products of comparable featured and equal quality may be substituted for the above items with approval of the Engineer.

3. CONSTRUCTION METHODS

See Section 022020, "Excavation and Backfill for Utilities and Sewers"

Service lines shall be placed by the Contractor as indicated on the drawings and as directed by the Engineer.

Relocation of existing meters and changeover to the new system shall be done only under the direct supervision of the Owner Water Department.

4. MEASUREMENT

Service lines shall be measured with the units indicated in the proposal for each size of service line indicated in the proposal.

5. PAYMENT

Payment for service lines shall include but not be limited to the following: copper tubing, corporation stop, service clamp, angle meter stop, trenching, trench safety, testing, flushing, clean-up, site restoration, all labor, all equipment, and incidentals required for the proper installation as part of the project lump sum bid or as indicated on the bid documents.

END OF SECTION

SECTION 026416
FIRE HYDRANTS (S-86)

1. DESCRIPTION

This specification shall govern all work necessary to provide all fire hydrants required to complete this project.

2. MATERIALS

Concrete: Concrete shall have a minimum compressive strength of 2000 psi at 28 days.

Fire Hydrants:

The fire hydrants shall conform to AWWA C502-64 standard specifications for fire hydrants for ordinary water works service, except for changes, additions and supplementary details specifically outlined herein:

- a) Hydrants - Hydrants shall be of the traffic model type equipped with a safety flange or collar on both the hydrant barrel and stem.
- b) Type of Shutoff - The shutoff shall be of the compression type only.
- c) Inlet Connection - The inlet shall be ASA A-21.11 1964 mechanical joint for six-inch (6"), Class 150 ductile iron pipe. A complete set of joint material shall be furnished with each hydrant.
- d) Delivery Classifications - Each hydrant shall have two hose nozzles and one pumper nozzle.
- e) Bury Length - The hydrants shall be furnished in the bury length as indicated on drawings.
- f) Diameter (Nominal Inside) of Hose and Pumper Nozzles - The hose nozzles shall be two and one-half inches (2-½") inside diameter and the pumper nozzle shall be four inches (4") inside diameter.
- g) Hose and Pumper Nozzle Threads - The hose nozzles shall have two and one-half-inch (2-½") National Standard thread (7-½ threads per inch). The pumper nozzle shall have size (6) threads per inch with an outside diameter of 4.658 inches, pitch diameter of 4.543 inches, and a root diameter of 4.406 inches.
- h) Harnessing Lugs - None required.
- i) Nozzle Cap Gaskets - Required.
- j) Drain Openings - Required.
- k) Tapping of Drain Opening - Tapping of the drain opening for pipe threads is not required.
- l) Nozzle Chain - Not required.
- m) Direction to Open - The hydrants shall open left (counter clockwise).
- n) Color of Finish Above Ground Line - That portion of the hydrant above the ground line shall be painted chrome yellow.

- o) Shape and Size of Operating and Cap Nuts - The operating and cap nuts shall be tapered pentagon one and one-fourth inches (1-1/4") point to face at base and one and one-eighth inches (1-1/8") point to face at top of nut.
- p) Nozzle Cap Chains - Hydrants shall be furnished without nozzle cap chains.
- q) Size of Fire Hydrant - The main valve opening shall not be less than five and one-quarter inches (5-1/4") inside diameter.
- r) Valve Facing - The main valve facing of the hydrant shall be rubber with 90± Durometer hardness. When the main valve lower washer and stem nut are not an integral casting then the bottom stem threads shall be protected with a bronze cap nut and a bronze lock nut.
- s) Barrel Sections - The hydrant shall be made in two or more barrel sections with flanges connecting the barrel to the elbow and to the packing plate.
- t) Breakable Coupling - Hydrants shall be equipped with a breakable coupling on both the barrel section and the stem. The couplings shall be so designed that in case of traffic collision the barrel and stem collar will break before any other part of the hydrant breaks.
- u) Hydrant Adjustment - The hydrant shall be designed as to permit its extension without excavating after the hydrant is completely installed.
- v) Breakable Collars, Barrel and Stem - Weakened steel or weakened cast iron bolts that are used in the breakable barrel couplings will not be acceptable.
- w) Operating Stem - Stems that have operating thread located in the waterway shall be made of manganese bronze, Everdure, or other high quality non-corrodible metal. Stems that do not have operating threads located in the waterway must be sealed by a packing gland or "O"-ring seal located between the stem threads and waterway. Iron or steel stems shall be constructed with a bronze sleeve extending through the packing or "O"-ring seal area. The sleeve shall be of sufficient length to be in the packing gland "O"-ring seal in the both open and closed positions of the main valve. The sleeve shall be secured to the steel stem so as to prevent water leakage between the two when subjected to 300 pounds hydrostatic test pressure.

- x) Drain Valve Mechanism - Drain valves operating through springs or gravity are not acceptable.
- y) Operating Stem Nut - The operating stem nut shall be designed to prevent seepage or rain, sleet, and the accumulation of dust between the operating nut and the hydrant top.
- z) Packing Gland or "O"-Ring Seal - Fire hydrants having the threaded part of the stem at the hydrant top shall be equipped with a packing gland or an "O"-ring seal immediately below the threaded section of the stem.

3. CONSTRUCTION METHODS

Fire hydrants shall be installed as shown on drawings. Minimum burial length shall be 3 feet. Breakable couplings shall be located at least 2 inches and less than 6 inches above finish grade.

Hydrants and fittings shall be stored on timber and kept clean. The interior surfaces of hydrants and fittings shall be washed and sterilized with approved sterilizing agent, if requested by the Engineer at the time of installation.

4. CERTIFICATION

The manufacturer shall furnish to the Engineer two (2) certified sets of prints showing complete details and dimensions of the hydrant.

The manufacturer shall furnish to the Engineer one (1) certified copy of the physical tests of all metals used in the manufacture of the fire hydrant that is normally manufactured and that will meet these specifications.

5. MEASUREMENT AND PAYMENT

Unless indicated otherwise in the Proposal, fire hydrants will be measured as a unit per each. Payment shall include, but not be limited to, furnishing and installing the complete fire hydrant assembly with valve, 6-inch line and fitting on the main; and shall be full compensation for all labor, materials, tools, equipment and incidentals required to properly complete the work.

END OF SECTION

SECTION 027200
CONTROL OF WASTEWATER FLOWS
(TEMPORARY BYPASS PUMPING SYSTEMS)

1. GENERAL

1.1 DESCRIPTION

A. This specification shall govern all work necessary for designing, installing, implementing, operating, and maintaining a temporary bypass pumping and flow control system, as provided by the Contractor for the purpose of diverting wastewater flow around the work area for the duration necessary to complete the work (i.e., control of wastewater flows). The Contractor shall furnish all materials, labor, equipment, power, maintenance, and incidentals required to maintain continuous and reliable wastewater service in all lines for the duration of the project.

1.2 SUBMITTALS

A. Bypass Pumping Plan Form: It shall be the Contractor's responsibility to legibly and thoroughly complete, in its entirety, the attached Bypass Pumping Plan Form and submit it to the Engineer and/or the appropriate City staff for review and approval, prior to the installation of any pumping system proposed for use.

Unless the bypass pumping is associated with an emergency work order, the standard approval protocol is as follows: The Contractor prepares and submits the plan to the Engineer a minimum of 7 days prior to mobilizing to site. The Engineer reviews the bypass plan and coordinates approval with Engineering Services and the Operating Department. Engineer and City will put forth a reasonable level of effort to expedite the review and approval process. No deviation from the procedure shall be allowed.

B. Bypass Pumping Plan Schematic: In addition to the above referenced form, the Contractor shall also furnish a sufficiently detailed schematic drawing identifying the approximate location of all bypass pumping system components. The schematic drawing shall clearly label parallel/crossing streets, identify landmark structures, and depict the locations of all pumps and piping.

At a minimum, the bypass pumping plan schematic drawing and associated attachments should include the following items:

- 1) Pump curves showing designed operation point for this specific project
- 2) Approximate location of bypass system pumping components
- 3) Location of manhole or access point for suction and discharge
- 4) Configuration, routing, location and depth of the suction and discharge piping
- 5) General arrangement/type of additional support equipment.
- 6) Temporary pipe supports, anchoring and thrust restraint blocks, if required
- 7) Traffic Control Plan and Traffic Department permit if the bypass is within the right-of-way.

8) Description of the method for removing pressure and all wastewater from existing force mains being taken out of service, if necessary.

9) All other City-department and Regulatory requirements.

10) Sewer plugging locations, method, and types of plugs

11) Method of protecting discharge manholes or structures from erosion and damage.

1.3 RESPONSIBILITY / AUTHORITY

A. It is essential to the operation of the existing wastewater system that there is no interruption in the flow of wastewater throughout the duration of the project. The Contractor shall be completely responsible for designing, scheduling, providing, installing, operating, fueling and maintaining the temporary bypass pumping system in a manner that does not cause or contribute to overflows, releases, or spills of wastewater from the wastewater or bypass system. The Contractor shall neither anticipate nor expect any assistance from the City of Corpus Christi departments for any of the bypass operation.

B. Contractor shall provide a responsible employee to man the bypass system 24 hours per day, 7 days per week during operation. The monitoring employee shall be properly trained, experienced, and mechanically qualified such that they can quickly and effectively address any potential emergency and non-emergency situations associated with the bypass system which must remain in operation. The wastewater and bypass systems should be inspected at least once every 2 hours. The Contractor shall be responsible for ensuring that the wastewater collection system is not compromised during bypass installation or operation, and contractor shall ensure that the system operates properly during this period.

C. The Contractor shall consider and be responsible for the impacts on the collection system area, both upstream and downstream of the bypass and shall maintain the system in a manner that will protect public and private property from damage and flooding. Upstream impacts may include, but are not limited to backups and overflows. Downstream impacts may include, but are not limited to surcharges and overflows.

D. Contractor shall make all effort to minimize spills of raw wastewater during the improvements and bypassing. All spills and sanitary sewer overflows shall immediately be reported to the City at 361-826-2489 and the Contractor shall be solely responsible for wash down, clean-up and disinfection of said spillages or overflows to the satisfaction of the owner at no additional cost to the City of Corpus Christi.

E. The City is permitted through the Texas Commission on Environmental Quality to operate the wastewater system. The final authority comes from the City as to the operation of the wastewater system and as such it reserves the right to halt the bypassing operation at any time in order to maintain public health and safety.

2. PRODUCTS

2.1 MATERIALS

A. Bypass Pumps

1) Pumps shall be fully automatic self-priming pumps that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. Pre-approved manufacturers are Godwin or Rain-for-Rent. Approved equals may be considered by the Engineer if they meet all requirements in this specification but Contractor shall provide submittal package for Engineer's review and approval prior to installation. Pumps shall be equipped with critically silenced, sound attenuated enclosures with a maximum 65 dB (10-feet from pump), a diesel day tank with a minimum 24-hour runtime without refuel, and automatic start/stop controls for each pump.

2) Pumping capacity of the bypass pump shall be capable of handling the flow conditions at all times and shall provide a minimum of 1.5 times the existing capacity of whatever line or lift station is being bypassed.

3) The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. In critical installations, as determined by the Engineer, one standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

B. Suction and Discharge Piping: Determined according to pump size, flow calculations, system operating conditions, manhole depth, and length of suction piping in accordance with the pump manufacturers specifications and recommendations. In order to prevent the accidental spillage of flows, all discharge systems shall be temporarily constructed of heavy-duty pipe with positive restrained joints.

1) High Density Polyethylene (HDPE)

i. Homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults. Defective areas shall be cut out and butt-fusion welded as per manufacturer's recommendations.

ii. Assembled and joined at site using couplings, flanges, or butt-fusion method to provide leak proof joint, as per manufacturer's recommendations and ASTM D2657.

iii. Fusing must be performed by personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment. Fused joints shall be watertight and have tensile strength equal to that of pipe.

iv. HDPE is required to be used in or adjacent to environmentally sensitive areas.

2) Polyethylene Plastic Pipe (PE)

i. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on outside diameter, ASTM D1248 and ASTM D3550

ii. Homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.

3) Quick-Disconnect Steel Galvanized Pipe and Heavy-Duty Flexible Hoses

i. Must consist of heavy-duty steel with high tensile strength, x-ray welded, abrasion resistant and suitable for intended service with a maximum pressure rating of at least 174 PSI

ii. Bauer quick-disconnect fittings/joints shall be restrained and watertight. Joints shall consist of vacuum sealing O-rings to help pumps prime faster and perform at their designed flow rates with no leaks, even at high pressure ratings

iii. Joints shall provide 30-degree articulation at every coupling and shall not require perfect alignment to make each connection.

iv. The galvanized couplings shall not be hindered by sand, mud, and grit.

d. Valves and Fittings

i. Contractor shall provide valves and fittings as necessary and in accordance with the approved pipe materials shown above.

e. Plugs

i. Selected and installed according to size of line to be plugged, pipe, manhole configurations, and based on specific application.

ii. Prior to use, Engineer may inspect plugs for defects which may lead to failure.

iii. Contractor shall provide additional plugs in the case of failure

f. Miscellaneous

i. When temporary piping crosses local streets/roadways and private driveways, Contractor shall provide traffic ramps or covers designed, installed, and maintained for H-20 loading requirements while in use.

3. EXECUTION

3.1 SCHEDULING & COORDINATION

A. Unless the bypass pumping is associated with an emergency work order, the Contractor shall provide a minimum of 48 hour notice to the Engineer and Wastewater Department for the startup of bypass operations once the completed bypass plan has been approved by the design engineer. Unless needed otherwise for emergency work, no bypassing shall be initiated on Friday, Saturday or Sunday, or the day immediately preceding a City holiday.

B. Inclement Weather: The Contractor shall not be allowed to commence bypass operation should inclement weather be forecast for the period of the scheduled improvements.

C. Under special circumstances, as identified by the Engineer, where critical lines with large service areas are being bypassed, the Contractor is responsible for setting up a meeting between the Engineer/City/Operating Department to affirm and coordinate the approved bypass plan and to verify the intended site installation conforms to the approved plan. Engineer may also require the bypass system to be in service for at least 24-hours prior to taking existing gravity lines or force mains out of service to demonstrate reliability.

D. Before beginning bypass operations, the Engineer/City Operating Department must be notified for field verification of pumps, piping, and equipment, et3), to ensure the site installation conforms to the approved plan.

E. Before beginning bypass operations, the Contractor shall confirm appropriate emergency contact information has been provided to the City and Engineer on the Bypass Pumping Plan Form including emergency cell phone number of bypass operators/monitors responsibly manning the bypass system 24 hours per day along with the project superintendent and pump supplier.

F. The Contractor can work extended hours, if approved by the Engineer, to perform the improvements during the bypass operation. Work during extended hours cannot create a nuisance for the neighbors.

G. Once a lift station is taken out of service and bypass operations begun, work shall be continuous on the lift station improvements until all improvements are completed and the lift station is returned to normal service.

H. The Contractor shall cease bypass pumping operations and return flows to the new and/or existing wastewater system when directed by the Owner. This may be expected if the bypass system is not in accordance with this specification or if inclement weather is in the forecast.

3.2 INSTALLATION & OPERATIONS

A. Installation of Temporary Force Mains

1) Force mains may be placed along shoulder of road, medians, and/or outside of pavement. Do not place in streets or sidewalks without Engineers approval.

2) When temporary piping crosses local streets/roadways and/or private driveways, Contractor shall provide traffic ramps or covers designed, installed, and maintained for H-20 loading requirements while in use.

3) When traffic ramps cannot be used, install temporary piping in trenches and cover with temporary pavement, as approved by the Engineer.

B. Discharge piping to gravity lines or manholes shall be designed in such a manner as to prevent discharge from contacting manhole walls or benching with as minimal turbulence as possible.

C. Plugging or blocking of wastewater flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a manner that permits the wastewater flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

D. The Contractor shall not cut existing force mains or gravity lines until it is determined that the containment area in place is sufficient for handling any wastewater within the pipe.

E. Some locations may require multiple bypass systems. If bypass system is provided with air release valves, then the valve drains shall be piped to a manhole for discharge.

F. Upon completion of the bypass pumping operations, remove piping, restore property to pre-construction condition and restore pavement.

4. MEASUREMENT AND PAYMENT

Unless otherwise specified in the Bid Form, Control of Wastewater Flows (Temporary Bypass Pumping Systems) shall not be measured for pay but will be considered subsidiary to the applicable pay item, to

include all material, labor, equipment and supervision necessary to complete the bypass design, planning, coordination, installation, operation, maintenance and removal.

END OF SECTION

SECTION 027202
MANHOLES

1. DESCRIPTION

This specification shall govern the furnishing of all materials and construction of manholes composed of a concrete base and concrete walls as shown on the drawings, to the lines, grades and dimensions shown on drawings or established by the Engineer.

2. MATERIALS

Concrete for cast-in-place storm water manholes and storm water junction boxes shall be Class C (3,600 psi at 28 days). Manholes for wastewater shall be made from fiberglass only, in accordance with City Standard Specification Section 027205 "Fiberglass Manholes".

Mortar for plastering shall be one (1) part Portland cement to three (3) parts clean hard and sharp mortar sand, free of all foreign substances or injurious alkalis.

Reinforcing steel, where used, shall conform to the requirements of Section 032020 "Reinforcing Steel". All wastewater manhole rings and covers for streets shall be East Jordan Iron Works, Inc. product V1430 CV or V1420/1480 Z1, or pre-approved equal, and shall have the seating surface of ring and cover machined to secure a snug fit per the contract drawing Wastewater Details. All storm water manholes shall be East Jordan Iron Works, Inc. product V1168 assembly, and for school zones shall be a bolted assembly per the Contract Drawing Storm Water Details. Steps are not required for wastewater and storm water manholes.

Joint material for precast concrete manholes shall be Ram-Nek Flexible Plastic Gaskets as manufactured by K. T. Snyder Company, Houston, Texas, or an approved equal.

3. EXCAVATION

The Contractor shall do all necessary excavation for the various manholes, conforming to size and dimensions shown on plans plus a maximum of four (4) feet working room. Excavation shall not be carried to greater depth than required. Subgrade under manhole footings shall be compacted to not less than 95% Standard Proctor density. Shoring shall be the responsibility of the Contractor and shall be installed as necessary. Shoring shall not be removed or backfilled around until entire manhole is completed, unless authorized by the Engineer. Shoring shall remain in place at least twenty-four (24) hours after concrete work has been completed.

4. CONCRETE MANHOLES (STORM WATER ONLY)

(1) Formed-in-Place Manholes:

Where formed concrete is used, forms shall be built to dimensions shown on the contract drawing details. Inserts and openings shall be formed so concrete will not be injured during process of stripping forms. Forms shall be braced and tied to prevent spreading or bulging, and shall meet approval of the Engineer prior to placing concrete. Forms shall remain in place for minimum of twenty-four (24) hours, and shall be removed within a maximum time of seven (7) days after completion of concrete work. Reinforcing steel, if required, shall be as shown on the plans.

The bottom of manholes shall be carefully formed and inverted smoothly when

finished, with pipes cut to fit inside surface of walls.

(2) Precast Manholes

Precast manholes shall allow unobstructed view of all pipes connected to the manhole. Precast manholes shall be designed to support HS-20 traffic loading and designed by a Texas licensed professional engineer. The upper 18 inches of the corbel shall be brick to facilitate subsequent grade adjustment. Either concentric or eccentric cones may be required. Where not specified, eccentric cones shall be used. Manhole designs shall be submitted for approval by the Engineer.

5. GENERAL CONSTRUCTION METHODS

All items shall be installed as the work progresses and as shown on the standard details. Work shall be completed and finished in a careful workmanlike manner, with special care being given to sealing joints around all pipe extending through walls of the manholes. After finishing walls, the bottom of the manhole shall be completed by adding sufficient concrete to shape the bottom in conformity with requirements on the plans. Where old manholes are adjusted to meet new lines and grades, all old masonry or concrete shall be thoroughly cleaned and wetted before joining new masonry or concrete to it. HDPE adjustment rings are to be used to match roadway grade. A maximum of 18" of adjustment rings may be utilized.

6. BACKFILLING/LEAKAGE TESTING

Backfilling around the manholes shall commence as soon as concrete or masonry has been allowed to cure the required time and forms and shoring have been removed. Backfill shall be placed in layers of not more than six inches (6") and compacted to a minimum of 95% Standard Proctor density before next layer is installed. Wastewater manholes shall withstand a leakage test not to exceed the values stated in Specification Section 027205 "Fiberglass Manholes", except that an additional 10 percent of loss will be permitted for each additional two feet head over a basic two-foot internal head.

7. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, manholes shall be measured by each individual structure built, and paid for at the unit price bid per each, of the size, type and depth specified, complete in-place, and meeting the approval of the Engineer. "Complete in-place" shall mean all labor, materials, tools, equipment and incidentals necessary to furnish and install the manholes, excavation, compaction, backfilling, dewatering, concrete foundation, connections, adjustment rings, ring and cover, concrete work, leakage testing, video inspection, and adjust the manholes to finish grade.

Extra depth for wastewater manholes over six feet in depth shall be measured by the vertical foot and shall be paid for at the price bid per vertical foot for "Extra Depth for Manholes".

Rehabilitation of existing manholes with fiberglass inserts shall be measured by each individual structure rehabilitated, and paid for at the unit price bid per each, of the size, type and depth specified, complete in-place, and meeting the approval of the Engineer. "Complete in-place" shall mean all labor, materials, tools, equipment and incidentals necessary to furnish and install the rigid fiberglass manhole inserts, make connections, grout the annular space, backfilling, adjustment rings,

ring and cover, concrete work, leakage testing, and adjust the manholes to finish grade.

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 027402
REINFORCED CONCRETE PIPE CULVERTS

1. DESCRIPTION

This specification shall govern the furnishing and placing of reinforced concrete pipe culverts and the material and incidental construction requirements for reinforced concrete pipe sewers. The culvert pipe shall be installed in accordance with the requirements of these specifications to the lines and grades shown on the plans, and shall be of the classes, sizes and dimensions shown thereon. The installation of pipe shall include all joints or connections to new or existing pipe, headwalls, etc., as may be required to complete the work.

2. MATERIALS

2.1 GENERAL

Except as modified herein, materials, manufacture and design of pipe shall conform to ASTM C-76 for Circular Pipe. All pipe shall be machine made or cast by a process which will provide for uniform placement of the concrete in the form and compaction by mechanical devices which will assure a dense concrete. Concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete will not be acceptable for use in precast concrete pipe.

2.2 DESIGN

All pipe shall be Class III (Wall "B") unless otherwise specified on the plans. The shell thickness, the amount of circumferential reinforcement and the strength of the pipe shall conform to the specified class as summarized in ASTM C-76 for Circular Pipe.

2.3 SIZES AND PERMISSIBLE VARIATIONS

- a. Variations in diameter, size, shape, wall thickness, reinforcement, placement of reinforcement, laying length and the permissible underrun of length shall be in accordance with the applicable ASTM Specification for each type of pipe as referred to previously.
- b. Where rubber gasket pipe joints are to be used, the design of the Joints and Permissible Variations in Dimensions shall be in accordance with ASTM C-443.

2.4 WORKMANSHIP AND FINISH

Pipe shall be substantially free from fractures, large or deep cracks and surface roughness. The ends of the pipe shall be normal to the walls and centerline of the pipe within the limits of variations allowed under the applicable ASTM specification.

2.5 CURING

Pipe shall be cured in accordance with the applicable ASTM Specification for each type of pipe as referred to above.

2.6 MARKING

The following information shall be clearly marked on each section of pipe:

- a. The class of pipe.
- b. The date of manufacture.
- c. The name or trademark of the manufacturer.
- d. Marking shall be indented on the pipe section or painted thereon with waterproof paint.

2.7 MINIMUM AGE FOR SHIPMENT

Pipe shall be considered ready for shipment when it conforms to the requirements of the tests specified herein.

2.8 INSPECTION

The quality of materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the Engineer at the pipe manufacturing plant. In addition, the finished pipe shall be subject to further inspection by the Engineer at the project site prior to and during installation.

2.9 CAUSES FOR REJECTION

Pipe shall be subject to rejection on account of failure to conform to any of the specification requirements. Individual sections of pipe may be rejected because of any of the following:

- a. Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint.
- b. Defects that indicate imperfect proportioning, mixing and molding.
- c. Surface defects indicating honeycombed or open texture.
- d. Damaged ends, where such damage would prevent making a satisfactory joint.

2.10 REPAIRS

Pipe may be repaired if necessary, because of occasional imperfections in manufacture or accidental injury during the handling, and will be acceptable if, in the opinion of the Engineer, the repairs are sound and properly finished and cured and the repaired pipe conforms to the requirements of the specifications.

2.11 REJECTIONS

All rejected pipe shall be plainly marked by the Engineer and shall be replaced by the Contractor with pipe that meets the requirements of these specifications. Such rejected pipe shall be removed immediately from the worksite.

2.12 JOINTING MATERIALS

Unless otherwise specified on the plans, the Contractor shall have the option of making the joints by any of the following methods:

a. Ram-Nek, a pre-formed plastic base joint material manufactured by K. T. Knyder Company, Houston, Texas, or an approved equal. Use of Talcote as joint material will not be not permitted. Ram-Nek joint material and primer shall be supplied for use on pipe in the following sizes, which is the minimum that will be required.

Additional Ram-Nek may be required if, in the opinion of the Engineer, a proper joint is not secured.

<u>Pipe Size</u>	<u>Primer Per 100 Jts.</u>	<u>Cut Lengths Per Joint</u>
12"	1.5 gals.	½ pcs 1" x 2'-5"
15"	1.9 gals.	2 pcs 1" x 2'-5"
18"	2.7 gals.	1½ pcs 1½ " x 3'-5"
21"	3.8 gals.	2 pcs 1½ " x 3'-5"
24"	6.2 gals.	2 pcs 1½ " x 3'-5"
30"	8.5 gals.	2½ pcs 1½ " x 3'-5"
36"	9.5 gals.	3 pcs 1¾" x 3'-5"
42"	12.0 gals.	3½ pcs 1¾" x 3'-5"
48"	15.0 gals.	4 pcs 1¾" x 3'-5"
54"	20.0 gals.	4½ pcs 1¾" x 3'-5"
60"	25.0 gals.	5 pcs 1¾" x 3'-5"
66"	30.0 gals.	5½ pcs 1¾" x 3'-5"
72"	32.0 gals.	6 pcs 2" x 3'-5"
84"	35.0 gals.	7 pcs 2" x 3'-5"

b. TYLOX Types "C", "C-P" or "CR" rubber gaskets, as applicable, as manufactured by Hamilton Kent Manufacturing Company, Kent, Ohio, or approved equal. All gaskets, lubricants, adhesives, etc., shall be manufactured, constructed, installed, etc., as recommended by the manufacturer of the rubber gasket material and conform to ASTM Designation: C-443. In addition, the Contractor shall furnish to the City, for approval, manufacturer's brochures detailing the complete use, installation, and specifications of concrete pipe and rubber gaskets before any rubber gasket material is used on the project. All rubber gaskets shall be fabricated from synthetic rubber.

c. Cement Mortar is prohibited from jointing pipe except at manholes, pipe junctions, etc., or where specifically approved by the Engineer.

d. Geotextile for wrapping pipe joints shall be Class "A" subsurface drainage type in accordance with AASHTO M288.

3. CONSTRUCTION METHODS

Reinforced concrete pipe culverts shall be constructed from the specified materials in accordance with the following methods and procedures:

3.1 EXCAVATION

All excavation shall be in accordance with the requirements of Specification Section 022020 "Excavation and Backfill for Utilities," except where tunneling or jacking methods are shown on the plans or permitted by the Engineer.

When pipe is laid in a trench, the trench, when completed and shaped to receive the pipe, shall be of sufficient width to provide free working space for satisfactory bedding and jointing and thorough tamping of the backfill and bedding material under and around the pipe. The Contractor shall make such temporary provisions as may be necessary to insure adequate drainage of the trench and bedding during the construction operation. Pipe shall be placed such that the identification markings are visible at the top prior to backfill.

3.2 BEDDING

The pipe shall be bedded in accordance with the bedding details shown on the drawings. Bedding shall not be measured for pay, but shall be subsidiary to other work. If the subgrade of the trench is unstable, even if this condition occurs at relatively shallow depths, full encasement of the pipe with crushed stone shall be required.

3.3 LAYING PIPE

Unless otherwise authorized by the Engineer, the laying of pipe on the prepared foundation shall be started at the outlet (downstream) end with the spigot or tongue end pointing downstream, and shall proceed toward the inlet (upstream) end with the abutting sections properly matched, true to the established lines and grades. Where bell and spigot pipe are used, cross trenches shall be cut in the foundation to allow the barrel of the pipe to rest firmly upon the prepared bed. These cross trenches shall be not more than two inches larger than the bell ends of the pipe. Proper facilities shall be provided for hoisting and lowering the sections of pipe into the trench without disturbing the prepared foundation and the sides of the trench. The ends of the pipe shall be carefully cleaned before the pipe is placed. As each length of pipe is laid, the mouth of the pipe shall be protected to prevent the entrance of earth or bedding material. The pipe shall be fitted and matched so that when laid in the bed, it shall form a smooth, uniform conduit. When elliptical pipe with circular reinforcing or circular pipe with elliptical reinforcing is used, the pipe shall be laid in the trench in such position that the markings "TOP" or "BOTTOM" shall not be more than 5 degrees from the vertical plane through the longitudinal axis of the pipe.

For pipe over 42 inches in diameter, the Contractor may drill two holes not larger than 2 inches in diameter, in the top of each section of the pipe, to aid in lifting and placing.

The holes shall be neatly drilled, without spalling of the concrete, and shall be done without the cutting of any reinforcement. After the pipe is laid, the holes shall be filled with mortar and properly cured, and placed such that they are visible from the top for inspection prior to backfill.

Multiple installations of reinforced concrete pipe shall be laid with the center lines of individual barrels parallel. When not otherwise indicated on plans, the following clear distances between outer surfaces of adjacent pipe shall be used.

Diameter of Pipe	18"	24"	30"	36"	42"	48"	54"	60" to 84"
Clear Distance Between Pipes	0'-9"	0'-11"	1'-1"	1'-3"	1'-5"	1'-7"	1'-11"	2'-0"

1. Jointing.

a. If the use of Portland cement mortar joints is allowed, all pipe shall be jointed tight and sealed with stiff mortar, composed of one part Portland cement and two parts sand, so placed as to form a durable water-tight joint. The installation shall be as required by the Engineer.

b. Joints using Rubber Gaskets: Where rubber gasket pipe joints are required by the plans, the joint assembly shall be made according to the recommendations of the gasket manufacturer. Water-tight joints will be required when using rubber gaskets.

c. Joints using Cold-Applied Preformed Plastic Gaskets shall be made as follows:

A suitable prime of the type recommended by the manufacturer of the gasket joint sealer shall be brush-applied to the tongue and groove joint surfaces and the end surfaces and allowed to dry and harden. No primer shall be applied over mud, sand or dirt or sharp cement protrusions. The surface to be primed must be clean and dry when primer is applied.

Before laying the pipe in the trench, the plastic gasket sealer shall be attached around the tapered tongue or tapered groove near the shoulder or hub of each pipe joint. The paper wrapper shall be removed from one side only of the two-piece wrapper on the gasket and pressed firmly to the clean, dry pipe joint surface. The outside wrapper shall not be removed until immediately before pushing the pipe into its final position.

When the tongue is correctly aligned with the flare of the groove, the outside wrapper on the gasket shall be removed and the pipe shall be pulled or pushed home with sufficient force and power (backhoe shovel, chain hoist, ratchet hoist or winch) to cause the evidence of squeeze-out of the gasket material on the inside or outside around the complete pipe joint circumference. The extruded gasket material shall be smoothed out over the joint on the exterior and interior of the pipe. Any joint material pushed out into the interior of the pipe that would tend to obstruct the flow shall be removed. (Pipe shall be pulled home in a straight line with all parts of the pipe on line and grade at all times.) Backfilling of pipe laid with plastic gasket joints may proceed as soon as the joint has been inspected and approved by the Engineer. Special precautions shall be taken in placing and compacting backfill to avoid damage to the joints.

When the atmospheric temperature is below 60 degrees F, plastic joint seal gaskets shall either be stored in an area warmed to above 70 degrees F, or artificially warmed to this temperature in a manner satisfactory to the Engineer. Gaskets shall then be applied to pipe joints immediately prior to placing pipe in the trench, followed by connection to previously laid pipe.

d. Pipe Joints for storm sewers shall be wrapped with geotextile material. The geotextile wrap shall be at least 2 feet wide and shall be centered on each joint.

2. After the pipe has been placed, bedded and jointed as specified, filling and/or backfilling shall be done in accordance with the applicable requirements of Specification Section 022020 "Excavation and Backfill for Utilities." If unstable conditions are encountered, fully encase the pipe with crushed stone as described above. When mortar joints are allowed, no fill or backfill shall be placed until the jointing material has been cured for at least six (6) hours.

Special precautions shall be taken in placing and compacting the backfill to avoid any movement of the pipe or damage to the joints. For side drain culverts and all other culverts where joints consist of materials other than mortar, immediate backfilling will be permitted.

3. Unless otherwise shown on the plans or permitted in writing by the Engineer, no heavy earth moving equipment will be permitted to haul over the structure until a minimum of 4 feet of permanent or temporary compacted fill has been placed thereon. Pipe damaged by the Contractor's equipment shall be removed and replaced by the Contractor at no additional cost.
4. Cleaning and Television Inspection. All enclosed reinforced concrete pipe and manholes installed on this project shall be cleaned and televised in accordance with Specification Section 027611 "Cleaning and Televised Inspection of Conduits."

4. MEASUREMENT

Unless otherwise specified on the Bid Form, reinforced concrete pipe will be measured by the linear foot. Such measurement will be made between the ends of the pipe barrel along its central axis. Where spurs or branches, or connections to existing pipe lines are involved, measurement of the spur or new connecting pipe will be made from the intersection of its center axis with the outside surfaces of the pipe into which it connects. Where inlets, headwalls, catch basins, manholes, junction chambers, or other structures are included in lines of pipe, that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.

For multiple pipes, the measured length will be the sum of the lengths of the barrels measured as prescribed above.

5. PAYMENT

Payment for reinforced concrete pipe measured as prescribed above will be made at the contract unit price bid per linear foot for the various sizes of "Reinforced Concrete Pipe" of the class specified.

Payment shall be full compensation for furnishing and transporting the pipe; hauling and placing of earth cushion material where required for bedding pipe; for the preparation and shaping of beds; for hauling, placing and jointing of pipes; for furnishing and installing geotextile pipe joint wrapping; for end finish; for all connections to existing and new structures; for cleaning and television inspection; and for all other items of materials, labor, equipment, tools, excavation, backfill and incidentals necessary to complete the culvert or storm sewer in accordance with the plans and these specifications.

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 027404
CONCRETE BOX CULVERTS

1. DESCRIPTION

This specification shall govern all work required for constructing, furnishing, and installing reinforced concrete box culverts required to complete the project.

All reinforced concrete boxes for this project shall be precast concrete in accordance with TxDOT Standards for precast box culverts and the details shown on the drawings for the appropriate height of fill, and design shall conform to ASTM C1577.

Alternate designs of precast boxes will be considered for approval upon submission of shop drawings detailing the box and certifications that the box, as designed, is structurally comparable to or better than the box shown in the contract drawings and is designed to support HS20 loading per ASSHTO M273. The shop drawings and certifications shall be signed and sealed by a Texas registered professional engineer.

2. MATERIALS

1. Concrete.

Unless otherwise shown on the plans, Class "C" concrete shall be used for cast-in place boxes, conforming to the requirements of Specification Section 030020

"Portland Cement Concrete" and Specification Section 038000 "Concrete

Structures", except that Class "S" concrete will be required for top slabs of direct traffic cast-in place boxes.

Concrete for precast (machine-made) boxes shall meet the requirements of ASTM C76 Sections: "Cement", "Aggregates" and "Mixture", and shall have a minimum 28-day compressive strength of 5,000 psi.

2. Reinforcement.

Reinforcing steel shall conform to the requirements of Specification Section 032020 "Reinforcing Steel" and the details shown on the plans.

3. Jointing.

Materials for jointing shall conform to the requirements of Specification Section 027402 "Reinforced Concrete Pipe Culverts".

4. Membrane Curing.

Materials for membrane curing shall conform to Specification Section 038000 "Concrete Structures".

5. Geotextile.

Geotextile fabric for wrapping joints shall be Class 1 geotextile for subsurface drainage with an average opening size (AOS) of 0.22mm and in accordance with AASHTO M288.

3. FABRICATION

The requirement of Specification Section 030020 "Portland Cement Concrete" and Specification Section 038000 "Concrete for Structures" shall govern for cast-in-place concrete box culverts and for precast (formed) boxes except where otherwise specified herein. Forms for precast (machine-made) boxes shall be made of steel. Forms for cast-in-place boxes and precast (formed) boxes may be either wood or steel.

Forms shall be mortar-tight and of sufficient strength to prevent excessive bulging or misalignment of adjacent boxes. They shall be constructed to permit their removal without damage to the concrete. Offsets at form joints shall not exceed one-eighth inch (1/8"). Forms shall be clean and free of extraneous matter when concrete is placed.

Positive means of supporting steel cages in place throughout forming and concrete placement shall be required and subject to the approval of the Engineer. Welding of reinforcing steel will be permitted only where shown on the plans. Welding shall be done by a qualified welder and shall conform to industry standards.

Precast (machine-made) boxes shall be cast by a process which will provide for uniform placement of the concrete in the forms and compaction by mechanical devices which will assure dense concrete. Concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete shall not be acceptable for use in precast (machine-made) boxes.

4. TESTING AND CERTIFICATION

1. Physical Requirements.

Precast boxes shall meet the requirement of ASTM C1577. Testing shall be done by a materials engineering testing laboratory which meets the requirements for membership in the American Council of Independent Laboratories.

2. Fabrication Tolerances.

Precast boxes shall conform to the following tolerances:

When two box sections are fitted together on a flat surface, in proper alignment and in the position they will be installed, the longitudinal opening at any point shall not exceed one inch (1").

Not more than four lifting holes may be provided in each box to facilitate handling. They may be cast-in, cut into the fresh concrete after form removal or drilled, and shall not be more than 2 inches

in diameter or 2 inches square. Cutting or displacement of the reinforcement will not be permitted.

Spalled areas around the holes shall be repaired. Concrete boxes shall be given an "Ordinary Surface Finish" in accordance with Section 038000 "Concrete Structures".

3. Certification.

Certification of quality shall be provided with each delivery of materials to the job site by the manufacturer. Certification shall be a written report by the materials engineering testing laboratory.

4. DEFECTS AND REPAIRS

Fine cracks or checks on the surface of the member which do not extend to the plane of the nearest reinforcement will not be cause for rejection unless they are numerous and extensive. Cracks which extend into the plane of the reinforcing steel but are acceptable otherwise, shall be repaired in an approved manner.

Small damaged or honeycombed areas which are purely surficial in nature may be repaired. Excessive damage, honeycombing or cracking will be subject to structural review. Repairs shall be sound, properly finished, and cured in conformance with the pertinent specifications. When fine cracks or hairline cracks on the surface indicate poor curing practices, further production of precast boxes shall be discontinued until corrections are made and proper curing provided.

5. CONSTRUCTION METHODS

Excavation and backfill shall be in accordance with Specification Section 022020 "Excavation and Backfill for Utilities" and contract drawing details for Stormwater. Bedding for precast concrete box culverts located under pavements shall consist of 6 inches of cement-stabilized sand containing a minimum of 1½ sacks of Standard Type I or Type II Portland cement per cubic yard of sand and compacted to not less than 95% Standard Proctor density.

Unless otherwise shown on the plans, the Contractor may use any of the jointing materials, except rubber gaskets, and shall comply with the jointing requirements specified in the Specification Section 027402 "Reinforced Concrete Pipe Culverts".

All box joints shall be wrapped with geotextile fabric. The wrap shall be at least two (2) feet wide and centered on the joints.

Lifting holes shall be filled with mortar or concrete and cured to the satisfaction of the Engineer.

6. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, concrete box culverts shall be measured by the linear foot for each size of box installed. The measurement will be made between the ends of the box along the centerline. For boxes used in the multiple barrel structures, the measured length will be the sum of the lengths of all barrels.

Payment shall be made at the contract bid price and shall fully compensate the Contractor for furnishing, transporting and installing the box culverts; for bedding materials and bed preparation including compaction; for excavation and backfill of trenches; for all connections to existing and new structures; and for all labor, materials, tools, equipment and incidentals required to complete the work as shown on the contract drawings and as specified herein.

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 027602
GRAVITY SANITARY SEWER

1. DESCRIPTION

This specification shall govern all work required for furnishing, handling, and installing gravity sanitary sewers required to complete the project.

2. MATERIALS

A. Pipe and Fillings:

1. ~~VITRIFIED CLAY PIPE (VCP) and fittings shall be "Extra Strength" in accordance with ASTM C-700. Pipe shall have a minimum laying length of 6 feet, unless indicated otherwise on the plans. All joints shall be in accordance with ASTM C-425. Joints for pipe and fittings with a nominal diameter of 18 inches or less shall be Plain End (PEP); for larger sizes either PEP or Bell and Spigot.~~
2. POLY-VINYL CHLORIDE (PVC) PIPE and fittings shall be in accordance with ASTM D-3034. Pipe shall have an SDR of 26. Pipe and fittings shall have push-on compression gasket joints in accordance with ASTM D-3212.

B. Bedding Materials:

1. CRUSHED STONE shall be well graded angular crushed stone in the general size range of 3/4" to 1/16" which has good stability. Crushed stone shall be graded in accordance with Size #67 and #68 of AASHTO M 43, ASTM D 448.
2. SAND shall be sands with very little or no fines. Soils with a Unified System Classification of SW and SP, or an AASHTO classification of A-3 shall be required.
3. GRAVEL shall be gravel with less than 10% by weight fines. The sieve analysis of gravel shall be in accordance with Size #67 or #68 of AASHTO M43, ASTM D 448.
4. ~~CONCRETE shall be Class B concrete in accordance with City Standard Specification Section 030020 for "Portland Cement Concrete".~~

C. Backfill Materials:

1. INITIAL BACKFILL is that material from the top of the bedding material to an elevation within 12 inches of the top of the pipe. This material shall be in accordance with City Standard for "Select Material" or material with a binder having a Plasticity Index between 0 & 13 and a liquid limit less than 46. The material shall be free of vegetation, debris, rocks with a diameter over 1.5 inches and clay lumps. This material shall not include soils with a Unified System Classification of OL, MH, OH, CH, and PT or soils with an

AASHTO classification of A-7.

2. FINAL BACKFILL is that material placed on the initial backfill. The material shall be in accordance with a standard specification Section 022020 "EXCAVATION AND BACKFILL FOR UTILITIES AND SEWERS".

3. CONSTRUCTION METHODS

A. Trench Excavation:

See standard specification Section 022020 "EXCAVATION AND BACKFILL FOR UTILITIES AND SEWERS".

B. Handling of Materials:

1. HANDLING AND CARE of pipe shall be the responsibility of the Contractor. Pipe shall be unloaded at the point of delivery, hauled to and distributed at the site by the Contractor. Materials shall be handled with care and in accordance with the manufacturer's recommendations.
2. STORAGE AND SECURITY of materials shall be provided by the Contractor. Any material delivered to the site that is not to be incorporated into the work within 10 working days shall be properly stored off the ground. Stacking and handling of materials shall be done as recommended by the manufacturer.
3. REJECTED OR DEFECTIVE materials are those having cracks, flaws, or other defects. Rejected materials shall be marked by the Engineer and removed from the job site by the end of the day by the Contractor.
4. DISTRIBUTION OF MATERIALS at the work site shall be allowed provided that they are incorporated into the work within 10 working days. Materials shall not be placed on private property, unless written permission has been obtained from the owner by the contractor. Materials shall not be placed within five feet of the back of curb or edge of pavement without permission of the Engineer.

C. Alignment and Grade:

1. All pipes shall be laid and maintained to the required line and grade.
2. NO DEVIATIONS from design line and grade shall be allowed, unless authorized by the Engineer.
3. The Contractor shall be provided with offsets and cut sheets. The Contractor may use batter boards, laser, or other approved methods necessary to construct the sewer to design line and grade.

D. Pipe Placement:

1. GENERAL: Proper implements, tools, etc. shall be used by the Contractor for safe and efficient execution of work. All pipes shall be carefully lowered into the trench by suitable equipment in such a manner as to prevent damage. Under no circumstances shall pipe be dropped or dumped into the trench. The Contractor shall not lay pipe in the trench until the bedding and condition of the trench has been approved by the Engineer. The trench shall be free of water and maintained in that condition until the pipe has been laid, the joints have been completed, and the initial backfill has been completed.
2. CLEAN PIPE: All foreign matter or dirt shall be removed from the interior of the pipe before lowering pipe into trench. The interior of pipe shall be maintained free of dirt during the remaining installation operations.

E. Jointing Pipe:

1. ~~VITRIFIED CLAY PIPE: ASTM C-12~~

~~PLAIN END PIPE (PEP) has a polyurethane elastomer molded to both ends of the pipe. The factory applied PVC sleeve, or collar may be removed and used on either end of the pipe. The mating surface shall be cleaned and lubricated prior to assembly. The pipe shall be aligned in the trench and shoved home to compress the joint and to assure a tight fit between the inner surfaces. Care shall be taken to avoid damaging the collar.~~

~~BELL AND SPIGOT PIPE shall have bell and spigot mating surfaces wiped clean and free of dirt and other foreign matter. A lubricant shall be applied to the mating surfaces just prior to joining. Bell holes shall be excavated into the bedding material. The spigot end shall then be centered on grade into the bell of the previous pipe and shall be shoved home to compress the joint and to assure a tight fit between the inner surfaces. Pipe shall not be assembled in reverse order by pushing bell onto spigot. Care shall be taken to avoid damaging the bell.~~

2. POLY-VINYL CHLORIDE PIPE shall have mating surfaces of the gasketed joint wiped clean of dirt and foreign matter. A lubricant recommended by the coupling manufacturer shall be applied to the bell and spigot mating surfaces just prior to joining. The spigot shall then be centered on grade into the bell of the previous pipe and shall be shoved home to compress the joint and to assure a tight fit between the inner surfaces. Pipe shall not be assembled in reverse order by pushing bell onto spigot. When the pipe is being thusly installed, bell holes shall be excavated in the bedding material. When the joint has been made, the bell hole shall be carefully filled with material to provide for adequate support of the pipe. The spigot shall be centered within 1/4 inch of the home line marked on the spigot.

F. Bedding and Initial Backfill:

1. ~~VITRIFIED CLAY PIPE: Bedding and initial backfill of VCP shall be in accordance with the details provided in the drawings. The class of bedding required will be dependent on trench width, pipe size and depth of cut. Bedding class shall be obtained from the table provided in the drawings.~~

~~CLASS A BEDDING: When included in the drawings shall be used for deep cut applications and shall include concrete cradle or concrete arch.~~

~~CLASS C BEDDING: When in a total sand environment, sand bedding material may be used in place of crushed stone or gravel.~~

~~CLASS D BEDDING: Shall require either bell holes or sand bottom as required for uniform support of pipe.~~

2. POLY-VINYL CHLORIDE PIPE: Bedding and initial backfill of PVC pipe shall be in accordance with the details provided in the drawings. Bedding shall be well tamped regardless of type. The type of bedding required shall depend upon the depth of cut and ground water condition and shall be as specified below:

BOTTOM OF TRENCH IN GROUNDWATER

<u>Depth of Cut</u>	<u>Required Bedding</u>
Less than 20 feet	Gravel or Crushed Stone
Over 20 feet	Crushed Stone

BOTTOM OF TRENCH NOT IN GROUND WATER

<u>Depth of Cut</u>	<u>Required Bedding</u>
Less than 15 feet	Sand, Gravel, or Crushed Stone
Less than 20 feet	Gravel or Crushed Stone
Over 20 feet	Crushed Stone

G. Final Backfill:

See standard specification Section 022020 "Excavation and Backfill for Utilities and Sewers".

4. TESTING AND CERTIFICATION

A. Leakage Testing: (Required for all types of pipe)

1. EQUIPMENT FOR LEAKAGE TESTING shall be furnished and installed by the Contractor.

The Contractor shall test the entire system for leaks. This work shall be witnessed by the Engineer.

2. ~~VITRIFIED CLAY PIPE shall be tested in accordance with ASTM C 828 Standard Practice for LOW-PRESSURE AIR TEST OF VITRIFIED CLAY PIPE LINES.~~
3. POLY-VINYL CHLORIDE (PVC) PIPE shall be tested in accordance with Uni-Bell Plastic Pipe Association "Recommended Practice for LOW- PRESSURE AIR TEST OF INSTALLED SEWER PIPE" UNI-B-6.

The test section of pipe shall be pressurized to 5 psi above the groundwater pressure. Once the pressure has stabilized, the time for a pressure drop from 3.5 to 2.5 psi shall be measured and not be less than the time indicated in the following table.

**MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015**

1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1 520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2 374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3 418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5 342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7 692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10 470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13 674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17 306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21 366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25 852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30 768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41 883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54 705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69 236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85 476 L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

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Note: If there has been no leakage (zero psig drop) after one hour of testing, the test section shall be accepted and the test complete. (See Section 7.5.)

A. Deflection Testing: (Required for PVC Pipe)

1. EQUIPMENT FOR DEFLECTION TESTING shall be provided by the Contractor. Mandrels shall be provided by the Contractor and shall be of machined rigid corrosion resistant pipe with a length not less than 1.5 diameters. Mandrels will be sized for SDR 26 PVC pipe at 5% deflection. The outside diameter of the standard mandrels shall be as follows:

<u>Nominal Size (inch)</u>	<u>Mandrel O.D. (inch)</u>
8	7.11
10	8.87
12	10.55
15	12.90
18	15.76
21	18.56
24	20.87
37	23.51
30	27.14

2. TESTING shall be done by the Contractor and witnessed by the Engineer. All pipe shall be tested for deflection no less than 30 days after placement of backfill. The Contractor may wish to check pipe immediately after backfilling for job control. However, this shall not qualify as acceptance testing. No pipe can be tested for formal acceptance until it has been in place, complete with backfill for at least 30 days.

C. Retesting:

ANY DEFECTIVE WORK OR MATERIALS shall be corrected or replaced by the Contractor and retested. This shall be repeated until all work and materials are acceptable.

5. SOIL BORINGS

The City does not assume responsibility for subsurface information. Soil data and other subsurface information shown on the plans or in the appendix is without warranty as to correctness of fact or interpretation.

6. BRACING AND SHORING

Trenching operation shall comply with Worker Safety Requirements for Excavation and Trenching Operations. If, for whatever reason, the trench width at the top of pipe must exceed that width indicated in the bedding details, the Contractor shall modify bedding as required by the Engineer to accommodate the additional load on the pipe.

7. MEASUREMENT & PAYMENT

Unless indicated otherwise in the Proposal, Gravity Sanitary Sewers shall be measured by the linear foot for each size and depth of sewer installed as follows:

- A. Between centers of manholes.
- B. From the center of a manhole to the end of the line.
- C. From the end of an existing stub to the end of the line or center of the existing manhole.

Depth shall be measured from flow line of pipe to ground surface over centerline of the pipe

at time of construction. Measurements to be made at manholes, at intervals not to exceed fifty feet, and at breaks in ground profile. Bedding shall not be measured and shall be considered subsidiary to pipe, unless included as a separate bid item in the proposal.

~~De-watering will be measured for pay by the linear foot of trench, if all the following conditions are met: (1) de-watering was included as bid item in the proposal by the Engineer; (2) de-watering of the trench was accomplished by well point system; and (3) the use of well points was necessary and was authorized by the Engineer.~~

Payment shall include all labor, pipe, bedding, de-watering, equipment for hauling, trench excavation, and all cleaning up and other incidentals necessary to install the pipe complete in place.

END OF SECTION

SECTION 027606
SANITARY SERVICE LINES

1. SCOPE

This specification governs all work and materials necessary to construct the Sanitary Services Lines required to complete the project. Sanitary Service Lines are those lines, constructed in public ROW, from the service tee on the main up to and including the clean-out at the property line.

2. MATERIALS:

Pipe and fittings for sanitary service lines shall be PVC in accordance with ASTM D2665 and ASTM D3311 with a minimum size of 4 inches. Solvent cement for PVC shall comply with ASTM D2564. No co-mingling of different materials except through the use of proper adaptors. Adaptors shall have a stainless steel or fiberglass shear ring.

3. CONSTRUCTION METHODS:

Where possible, service tees or wyes shall be placed along the main as required for services (no taps).

The minimum size pipe for services shall be 4" diameter for residential and 6" for commercial. Minimum slopes for 4" and 6" pipes shall be 1/8 (S=0.01) and 1/16 (S= 0.005) inches per foot respectively. Sanitary sewer service lines shall cross under water mains

The Contractor shall be responsible for establishing alignment and maintaining grade for the proposed service.

Trenches shall be excavated in such a manner which will minimize damage to surface improvements. After installation, the excavated material shall be tamped into the trench to a minimum of 95% Std. Proctor and the surface restored to a condition acceptable to the Engineer. Lines shall be bored, jetted, or jacked under sidewalks, driveways, and other such improved surfaces; unless authorized by the Engineer.

Service lines shall be leakage tested with the main sewer.

4. MEASUREMENT & PAYMENT:

Unless indicated otherwise in the Proposal, Sanitary Service Lines shall be measured as individual units for each connection made to the main. Measurement shall include but not be limited to; the line from the tee on the main to, and including, the clean-out at the property line. Payment shall include all labor, materials, equipment, trench safety and incidentals necessary for Sanitary Service Lines required to complete the project.

END OF SECTION

SECTION 028020

SEEDING

1. DESCRIPTION

This specification shall govern all work necessary for tilling, fertilizing, planting seeds, mulching, watering and maintaining vegetation required to complete the project.

2. MATERIALS

2.1 FERTILIZER

All fertilizer shall be delivered in bags or clearly marked containers showing the analysis, name, trademark and warranty. The fertilizer is subject to testing by the State Chemist in accordance with the Texas fertilizer law. Fertilizer shall have an analysis of 12-12-12 (percent of nitrogen, phosphoric acid and potash) as determined by the Association of Official Agricultural Chemists. Fertilizer shall be free flowing and uniform in composition.

2.2 SEED

Seed shall be labeled and meet the requirements of the Texas Seed Law. Labels shall indicate purity, germination, name and type of seed. Seed furnished shall be of the previous season's crop, and the date of analysis shown on each bag shall be within twelve months of delivery to the project.

The quantity of "Commercial Seed" required to equal the quantity of "Pure Live Seed" shall be computed by the following formula:

$$\text{Commercial Seed} = \text{Pure Live Seed} \times \frac{10,000}{\% \text{ Purity} \times \% \text{ Germination}}$$

The quantity of pure live seed and type required are indicated below. Mixture A or C shall be used for this project, depending on the time of the year planting is performed.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>	<u>LB/ACRE OF PURE LIVE SEED</u>		
		<u>FOR MIXTURES</u>		
		<u>A</u>	<u>B</u>	<u>C</u>
Green Sprangletop	Leptochloa Dubia	1.4	1.4	-
Sideoats Grama (premier)	Bouteloua Curtipendula	0.6	-	0.6
Bermudagrass (Hulled)	Cynodon Dactylon	7.0	7.4	-
Bermudagrass (Unhulled)	Cynodon Dactylon	-	-	30.0
K-R Bluestem	Andropogon Ischaemum	1.2	1.2	1.5
Buffalograss	Buchloe Dactyloides	-	4.2	-
Annual Ryegrass	Lolium Multiflorum	5.0	5.0	20.0

Mixture - A: Recommended for clay or tight soil planted between December 1 thru May 1.

Mixture - B: Recommended for sandy soil planted between December 1 thru May 1.

Mixture - C: Recommended for all soils planted between May 2 thru November 30.

2.3 MULCH

Mulch shall be either the straw type or wood cellulose fiber type.

Straw Type mulch shall be of straw from stalks of domestic grain, Bermudagrass or cotton hulls, or other

approved by the Engineer.

Wood Cellulose Fiber Type- mulch shall have no growth inhibiting ingredients and shall be dried with a moisture content less than 10% by weight. Fibers shall be dyed an appropriate color to facilitate visual metering and application of mulch. The cellulose fiber shall be manufactured so that after addition and agitation in slurry tank with fertilizers, seeds and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry; when sprayed on the ground, the material shall form a uniform cover impregnated with seeds; the cover shall allow added water to percolate to the underlying soil. The fiber material shall be supplied in packages of not more than 100 lb. gross weight and shall be marked by the manufacturer to indicate the dry weight content.

2.4 **EQUIPMENT:** The fertilizing, seeding and/or mulching operations shall be accomplished with equipment suitable to the required function. It shall be of current design and in good operating condition. Special seeding and mulching equipment must also meet the following requirements:

Seeder - Equipment for applying a seed-fertilizer mix shall be a hydraulic seeder designed to pump and discharge a waterborne, homogeneous slurry of seed and fertilizer. The seeder shall be equipped with a power driven agitator and capable of pressure discharge.

Straw Mulch Spreader - Equipment used for straw mulch application shall be trailer mounted, equipped with a blower capable of 2000 r.p.m. operation, and that will discharge straw mulch material through a discharge boom with spout at speeds up to 220 feet per second. The mulch spreader shall be equipped with an asphalt supply and application system near the discharge end of the boom spout. The system shall apply asphalt adhesive in atomize form to the straw at a predetermined rate. The spreader shall be capable of blowing the asphalt-coated mulch, with a high velocity airstream, over the surface at a uniform rate, forming a porous, stable erosion-resistant cover.

Wood Cellulose Fiber Mulch Spreader - Equipment used for this application of fertilizer, seeds, wood pulp, water and other additives shall have a built-in agitation system with sufficient capacity to agitate, suspend and homogeneously mix a slurry containing up to 40 lbs. of fiber plus the required fertilizer solids for each 100 gallons of water. It shall have sufficient agitation and pump capacity to spray a slurry in a uniform coat over the area to be mulched.

3. CONSTRUCTION METHODS

3.1 PREPARATION OF SEEDBED

The area to be treated along with requirements for seed, fertilizer and other treatments, shall be done as indicated on the drawings and as specified below.

Clearing – Refer to Standard Specification Section 021020, "Site Clearing and Stripping".

Grading - Refer to Standard Specification Section 021040, "Site Grading".

Tilling - The area to be seeded shall be tilled to a depth of 4 to 6 inches by disking, plowing, or other approved methods until soil condition is acceptable.

3.2 FERTILIZING

Fertilizer shall be uniformly applied at a rate of 400 lb/acre, after tilling. Fertilizing and seeding shall be done concurrently. If seeds and fertilizer are distributed in a water slurry, the mixture shall be applied to the area to be seeded within 30 minutes after all the components have come into contact.

3.3 SEEDING

The seed mixture shall be uniformly distributed at the rate specified above.

Broadcast Seeding - Seed shall be placed with fertilizer, after tilling. After planting, the area shall be rolled on contour with a corrugated roller.

Straw Mulch Seeding - Seed shall be placed with fertilizer, after tilling. After placement of the seed and fertilizer mixture, straw mulch shall be uniformly placed at a rate of 2 tons per acre. As soon as the mulch has been spread, it shall be anchored to the soil a minimum depth of 3 inches by use of a heavy, dulled disk harrow, set nearly straight. Disks shall be set approximately 9 inches apart.

Straw Mulch with Asphalt Seeding - Seed, fertilizer and straw mulch shall be placed as described in "Straw Mulch Seeding" with the following two exceptions: 1) An asphalt-water emulsion shall be applied to the mulch near the discharge end of the boom spout at a rate of 300 to 600 gallons per acre. 2) Mechanical anchoring by disking will not be required.

Asphalt Mulch Seeding - The seed and fertilizer shall be placed as described for "Broadcast Seeding". After the area has been rolled, the area shall be watered sufficiently to assure a uniform moisture to a minimum depth of 4 inches. An asphalt-water emulsion shall be applied at a rate of 1500 to 1800 gallons per acre, immediately after watering. Asphalt shall be applied to the area in such a manner that a complete film is obtained and the finished surface shall be comparatively smooth.

Wood Cellulose Fiber Mulch Seeding - After tilling, mulch shall be applied. Wood cellulose fibers shall be added to the hydraulic seeder after the proportionate amounts of seed, fertilizer, water and other approved materials are added. Application shall be 1500 lb./acre on flats, 2000 lb./acre on slopes up to 3:1, and 2500 lb./acre on slopes steeper than 3:1. One hundred (100) pounds of fiber per acre shall be used when asphalt is to be applied over cellulose mulch. The mulch shall provide a uniform cover over the soil surface.

Asphalt Over Wood Cellulose Fiber Mulch Seeding - "Wood Cellulose Fiber Mulch Seeding" shall be done as described above. After mulch has been placed, an asphalt-water emulsion shall be uniformly spread over the mulch at a rate of 1200 gallons per acre.

3.4 MAINTENANCE

The Contractor shall water, repair and reseed areas as required for a period of 45 days or until growth has been established, whichever is longer. This includes erosion damage. Maintenance does not include mowing or weed control, unless indicated on the plans. If at any time the seeded area becomes gullied or otherwise damaged, or the seeds have been damaged or destroyed, the affected portion shall be re-established to the specified condition prior to acceptance of the work.

3.5 GUARANTEE

The Contractor shall assure 95% of the seeded area has established growth at 45 calendar days after seeding, unless indicated otherwise on the drawings. Where established, growth is defined as at least one plant per square foot with no bare spots larger than ten (10) square feet.

4. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 028040
SODDING

1. DESCRIPTION

This specification shall govern all work necessary for furnishing and placing sod as required to complete the project.

2. MATERIALS

Fertilizer: All fertilizer used shall be delivered in bags or containers with clearly marked analysis. A granulated fertilizer shall be used with an analysis of 10-20-10. These figures represent the percent of nitrogen, phosphoric acid, and potash nutrients respectively, as determined by the methods of the Association of Official Agricultural Chemists. The rate of application shall be not less than 350 lb\acre (7.23 lb per 100 s.y). In the event that is necessary substitute a fertilizer with a different analysis, it shall be granulated fertilizer with a lower concentration. The total nutrients applied per unit area shall not be less that the specified amount of each nutrient.

Sod: Sod shall consist of live Bermuda grass with thickly matted roots throughout the soil and with a minimum thickness of 3 inches or .25 feet, or live St. Augustine with thickly matted roots throughout the soil with a minimum thickness of 1 inch or .08 feet. The Contractor shall not use sod where grass is thinned out. Grass shall be mowed and raked to remove all weeds and long stems prior to extraction at source. Sod and soil shall be kept moist at all times during sodding process. Care must be taken at all times to retain native soil on the root system.

Water: Water shall be free from oils, acids, alkalies, and salts which may inhibit grass growth. Unless indicated otherwise on the drawings, water shall be provided by the City and shall be transported and applied by the Contractor.

3. CONSTRUCTION METHODS:

Spot Sodding: Prior to planting, the area to be sodded shall be graded and shaped. Squares of sod with a minimum width of 3 inches shall be planted in rows on 15 inch centers in both directions. Sod shall be placed so that lit is firmly against the bottom of the hole; the top of the sod shall not be more than 2 inches below finished grade. Soil shall be firmly against all sides of the sod. Soil shall not be allowed to cover the sod except for soil incidental to raking, provided that the quantity of soil is not enough to hinder the growth. Areas to be spot sodded shall be indicated on the drawing or as directed by the Engineer in field. After sod has been planted, the area shall be fertilized and watered.

Block Sodding: Prior to planting, the area to be sodded shall be graded and shaped. Sod blocks shall be uniformly placed over the prepared area. The sodded area shall then be fertilized and watered. After the area is sufficiently dry, the area shall be rolled or tamped on form a thoroughly compacted mat. Any voids in the mats shall be filled with additional sod and tamped. If, in the opinion of the Engineer, sloped may cause displacement, areas

to be block sodded shall be indicated on the drawings or as directed by the Engineer in the field.

Mulch Sodding: The sod source shall be disked in two directions cutting the sod thoroughly to a depth of not less than 4 inches or more than 10 inches, being careful to avoid having soil containing no grass roots. The disked sod may be windrowed, or otherwise handled in a manner satisfactory to the Engineer. The material shall be rejected if not kept in a moist condition.

Prior to placing mulch sod, the cut slopes shall be scarified by plowing furrows 4 inches to 6 inches deep along horizontal slope lines at 2-foot vertical intervals. Excavated material from the furrows shall not protrude more than 3 inches above the original surface of the cut. Fertilizer shall be distributed uniformly over the area. The sod shall then be dumped upon the prepared area and spread uniformly to the required approximate thickness shown on plans.

Any section not true to lines and cross sections shall be remedied by the addition of sod material. After the sod material has been spread and shaped, it shall be compacted with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour. The area to be mulch sodded shall be indicated on the drawings or as directed by the Engineer in the field.

4. MEASUREMENT & PAYMENT

Unless indicated otherwise in the Proposal Sodding shall be measured by the square yard taken in a horizontal plan. Measurement of the Mulch Sodding shall be by the cubic yard of mulch delivered to place of planting. These items shall include but not be limited to: excavation, transporting, storing, and placing of sod; application of fertilizer and water.

END OF SECTION

SECTION 028200
MAILBOX RELOCATION

1. DESCRIPTION

This specification shall govern all work for relocation of mail boxes required to complete the project.

2. REQUIREMENTS

Where mail is delivered to residents by means of roadside mail boxes, the Contractor shall maintain access to these mail boxes throughout the course of construction. Due to the existing location of mail boxes, the Contractor shall, in some cases, be required to move the boxes to temporary locations. Upon completion of construction, the Contractor shall be required to erect the moved mail boxes to a permanent location. Any materials or labor required for either the temporary or permanent move shall be considered subsidiary, and no direct payment shall be made.

It is the intent of this item to provide the residents with mail box facilities at least equal to or better than those existing prior to construction.

In all cases, the temporary and permanent locations of all moved mail boxes shall be in accordance with U. S. Postal Service requirements with regard to height, distance from roadway, accessibility, etc. It shall be the Contractor's responsibility to contact the U. S. Postal Service and gather information as to their requirements.

3. MEASUREMENT AND PAYMENT

Unless included in the proposal as a bid item, all work and materials required for relocation of mail boxes shall not be measured for pay but will be considered to other work.

END OF SECTION

SECTION 028300
FENCES RELOCATION

1. DESCRIPTION

This specification shall govern all work necessary to accomplish the relocation of any fence which needs to be moved to complete this project. The necessity and the time schedule for relocation of any given fence shall be determined by the Engineer.

2. MATERIALS

Whenever possible, all or part of the existing fence materials shall be used in constructing the relocated fence. Any materials damaged or destroyed as a result of removal of the fence from its existing location shall be replaced with materials of equal or better quality.

3. CONSTRUCTION METHODS

It is the intent of this specification that fences be reconstructed to original condition (condition at time just prior to commencement of construction on this project). Unless otherwise specified, no fence shall be replaced until the area surrounding its new location has been worked to its finished grade. Any fence that is damaged while being removed shall be repaired prior to being reset.

4. MEASUREMENT& PAYMENT

Unless indicated otherwise in the Proposal, Fence Relocation shall be subsidiary to the other bid items.

END OF SECTION

SECTION 029500
TREES, PLANTS, AND GROUND COVER

1. GENERAL

1.1 SECTION INCLUDES

- A. Preparation of subsoil and topsoil.
- B. Topsoil bedding.
- C. Trees, plants, and ground cover.
- D. Mulch and fertilizer.
- E. Maintenance.

1.2 REFERENCES

- A. ANSI Z60.1 - Nursery Stock.

1.3 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horse- tail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perrenial Sorrel, and Brome Grass.
- B. Plants: Living trees, plants, and ground cover specified in this Section and described in ANSI Z60.1

1.4 QUALITY ASSURANCE

- A. Nursery: Company specializing in growing and cultivating the plants specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in installing and planting the plants specified in this Section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect plants until planted.
- C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant life when ambient temperatures may drop below 35 degrees F.

1.7 WARRANTY

- A. Provide a warranty on work of this Section for a minimum one year including one continuous growing season. Commence warranty on date identified in the Certificate of Substantial Completion.

- B. Warranty: Include coverage of plants from death or unhealthy conditions
- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.8 MAINTENANCE SERVICE

- A. Maintenance Services: Performed by installer
- B. Maintain plant life for six months after Date of Substantial Completion.
- C. Maintenance to include:
 - 1. Cultivation and weeding plant beds and tree pits.
 - 2. Application of herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
 - 3. Application of pesticides in accordance with manufacturer's instructions. Remedy damage from use of pesticides.
 - 4. Irrigating sufficient to saturate root system.
 - 5. Trimming and pruning, including removal of clippings and dead or broken branches, and treatment of pruned areas or other wounds.
 - 6. Disease control.
 - 7. Maintaining wrapping, guys, turnbuckles, and stakes. Repair or replace accessories when required.
 - 8. Mow grass at regular intervals to maintain proper height.

2. PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

- A. Trees, Plants, and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS

- A. Imported Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

2.3 SOIL AMENDMENT MATERIALS

- A. Fertilizer: Type recommended for plants with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis, to the following proportions: Nitrogen 13 percent, phosphoric acid 13 percent, soluble potash 13 percent.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight; 4 to 5 pH range; moisture content of 30 percent.
- C. Sand: Clean, washed, sharp sand.

- D. Gypsum: Agricultural grade.
- E. Soil Acidifier: Magno.
- F. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.

2.4 MULCH MATERIALS

- A. Mulching Material: Shredded bark free of growth or germination inhibiting ingredients.

2.5 ACCESSORIES

- A. Wrapping Materials: Burlap.
- B. Stakes: Preservative treated softwood lumber, pointed end.
- C. Cable, Wire: Non-corrosive, of sufficient strength to withstand wind pressure and resultant movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

3. EXECUTION

3.1 EXAMINATION

- A. Verify that prepared subsoil and planters are ready to receive work of this Section.
- B. Saturate soil with water to test drainage.
- C. Verify that required underground utilities are available, in proper location, and ready for use.
- D. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to a depth of 4 inches where plants are to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.
- D. Dig pits and beds as indicated.

3.3 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of 4 inches over area to be planted. Rake smooth.
- B. Place topsoil during dry weather and on dry subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low, or soft areas, and to ensure positive drainage.
- E. Install topsoil mixture in pits and beds intended for plant root balls to a minimum thickness as indicated on Drawings.

3.4 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.

3.5 PLANTING

- A. Place plants for best appearance for review and final orientation by Engineer.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers.
- D. Set plants in pits or beds, partly filled with prepared topsoil mixture.
- E. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.6 PLANT SUPPORT

- A. Brace plants vertically with plant protector wrapped guy wires and stakes as indicated.

3.7 FIELD QUALITY CONTROL

- A. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.8 SCHEDULE - PLANT LIST

- A. As indicated on drawings.

END OF SECTION

SECTION 030020
PORTLAND CEMENT CONCRETE

1. DESCRIPTION

This specification shall govern for the materials used; for the storing and handling of materials; and for the proportioning and mixing of concrete for culverts, manholes, inlets, curb and gutter, sidewalks, driveways, curb ramps, headwalls and wingwalls, riprap, and incidental concrete construction.

The concrete shall be composed of Portland cement, aggregates (fine and coarse), admixtures if desired or required, and water, proportioned and mixed as hereinafter provided.

2. MATERIALS

2.1 CEMENT

The cement shall be either Type I, II or III Portland cement conforming to ASTM Designation: C150, modified as follows:

Unless otherwise specified by the Engineer, the specific surface area of Type I and II cements shall not exceed 2000 square centimeters per gram (Wagner Turbidimeter – TxDOT Test Method Tex-310-D). For concrete piling, the above limit on specific surface area is waived for Type II cement only. The Contractor shall furnish the Engineer, with each shipment, a statement as to the specific surface area of the cement expressed in square centimeters per gram.

For cement strength requirements, either the flexural or compressive test may be used.

Either Type I or II cement shall be used unless Type II is specified on the plans. Except when Type II is specified on the plans, Type III cement may be used when the anticipated air temperature for the succeeding 12 hours will not exceed 60°F. Type III cement may be used in all precast prestressed concrete, except in piling when Type II cement is required for substructure concrete.

Different types of cement may be used in the same structure, but all cement used in any one monolithic placement shall be of the same type and brand. Only one brand of each type will be permitted in any one structure unless otherwise authorized by the Engineer.

Cement may be delivered in bulk where adequate bin storage is provided. All other cement shall be delivered in bags marked plainly with the name of the manufacturer and the type of cement. Similar information shall be provided in the bills of lading accompanying each shipment of packaged or bulk cement. Bags shall contain 94 pounds net. All bags shall be in good condition at time of delivery.

All cement shall be properly protected against dampness. No caked cement will be accepted.

Cement remaining in storage for a prolonged period of time may be retested and rejected if it fails to conform to any of the requirements of these specifications.

2.2 MIXING WATER

Water for use in concrete and for curing shall be free from oils, acids, organic matter or other deleterious substances and shall not contain more than 1000 parts per million of chlorides as CL nor more than 1000 parts per million of sulfates as SO_4 .

Water from municipal supplies approved by the State Health Department will not require testing, but water from other sources will be sampled and tested before use in structural concrete.

Tests shall be made in accordance with the "Method of Test for Quality of Water to be Used in Concrete" (AASHTO Method T26), except where such methods are in conflict with provisions of this specification.

2.3 COARSE AGGREGATE

Coarse aggregate shall consist of durable particles of gravel, crushed blast furnace slag, crushed stone, or combinations thereof; free from frozen material or injurious amount of salt, alkali, vegetable matter, or other objectionable material either free or as an adherent coating; and its quality shall be reasonably uniform throughout. It shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale, nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TxDOT Test Method Tex-413-A. It shall have a wear of not more than 40 percent when tested in accordance with TxDOT Test Method Tex-410-A.

Unless otherwise specified on the plans, coarse aggregate will be subjected to five cycles of the soundness test in accordance with TxDOT Test Method Tex-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used, or 18 percent when magnesium sulfate is used.

Permissible sizes of aggregate shall be governed by Table 4 and Table 1, except that when exposed aggregate surfaces are required, coarse aggregate gradation will be as specified on the plans.

When tested by approved methods, the coarse aggregate, including combinations of aggregates when used, shall conform to the grading requirements shown in Table 1.

TABLE 1
Coarse Aggregate Gradation Chart

Aggregate Grade No.	Nominal Size	Percent Retained on Each Sieve								
		2-½ In.	2 In.	1-½ In.	1 In.	¾ In.	½ In.	⅜ In.	No. 4	No. 8
1	2 in.	0	0 to 20	15 to 50		60 to 80			95 to 100	
2 (467)*	1-½ in.		0	0 to 5		30 to 65		70 to 90	95 to 100	
4 (57)*	1 in.			0	0 to 5		40 to 75		90 to 100	95 to 100
8	¾ in.						0	0 to 5	35 to 80	90 to 100

*Numbers in parenthesis indicate conformance with ASTM C33.

The aggregate shall be washed. The Loss by Decantation (TxDOT Test Method Tex-406-A) plus the allowable weight of clay lumps, shall not exceed one percent, or the value shown on the plans, whichever is smaller.

2.4 FINE AGGREGATE

Fine aggregate shall consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps. When subjected to the color test for organic impurities (TxDOT Test Method Tex-408-A), it shall not show a color darker than standard.

The fine aggregate shall produce a mortar having a tensile strength equal to or greater than that of Ottawa sand mortar when tested in accordance with TxDOT Test Method Tex-317-D.

Where manufactured sand is used in lieu of natural sand for slab concrete subject to direct traffic, the acid insoluble residue of the fine aggregate shall be not less than 28 percent by weight when tested in accordance with TxDOT Test Method Tex-612-J.

When tested by approved methods, the fine aggregate or combination of aggregates, including mineral filler, shall conform to the grading requirements shown in Table 2.

TABLE 2
Fine Aggregate Gradation Chart

<u>Aggregate Grade No.</u>	<u>Percent Retained on Each Sieve</u>							
	<u>3/8 In.</u>	<u>No. 4</u>	<u>No. 8</u>	<u>No. 16</u>	<u>No. 30</u>	<u>No. 50</u>	<u>No. 100</u>	<u>No. 200</u>
1	0	0 to 5	0 to 20	15 to 50	35 to 75	70 to 90	90 to 100	97 to 100

NOTE 1: Where manufactured sand is used in lieu of natural sand, the percent retained on the No. 200 sieve shall be 94 to 100.

NOTE 2: Where the sand equivalent value is greater than 85, the retainage on the No. 50 sieve may be 70 to 94 percent.

Fine aggregate will be subjected to the Sand Equivalent Test (TxDOT Test Method Tex-203-F). The sand equivalent shall not be less than 80 nor less than the value shown on the plans, whichever is greater.

For concrete Classes 'A' and 'C', the fineness modulus as defined below for fine aggregates shall be between 2.30 and 3.10.

The fineness modulus will be determined by adding the percentages by weight retained on the following sieves, and dividing by 100; Nos. 4, 8, 16, 30, 50 and 100.

2.5 MINERAL FILLER

Mineral filler shall consist of stone dust, clean crushed sand, or other approved inert material.

2.6 MORTAR (GROUT)

Mortar for repair of concrete shall consist of 1-part cement, 2-parts finely graded sand, and enough water to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce the color required. When required by the Engineer, latex adhesive shall be added to the mortar.

2.7 ADMIXTURES

Calcium Chloride will not be permitted. Unless otherwise noted, air-entraining, retarding and water-reducing admixtures may be used in all concrete and shall conform to the following requirements:

A "water-reducing, retarding admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and will retard the initial set of the concrete.

A "water-reducing admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency.

- (a) Retarding and Water-Reducing Admixtures. The admixture shall meet the requirements for Type A and Type D admixture as specified in ASTM Designation: C494, modified as follows:

- (1) The water-reducing retarder shall retard the initial set of the concrete a minimum of 2 hours and a maximum of 4 hours, at a specified dosage rate, at a temperature of 90°F.
- (2) The cement used in any series of tests shall be either the cement proposed for specific work or a "reference" Type I cement from one mill.
- (3) Unless otherwise noted on the plans, the minimum relative durability factor shall be 80.

The air-entraining admixture used in the referenced and test concrete shall be neutralized Vinsol resin.

(b) Air-Entraining Admixture. The admixture shall meet the requirements of ASTM Designation: C260, modified as follows:

- (1) The cement used in any series of tests shall be either the cement proposed for specific work or a "reference" Type I cement from one mill.
- (2) Unless otherwise noted on the plans, the minimum relative durability factor shall be 80.

The air-entraining admixture used in the referenced concrete shall be neutralized Vinsol resin.

3. STORAGE OF CEMENT

All cement shall be stored in well-ventilated weatherproof buildings or approved bins, which will protect it from dampness or absorption of moisture. Storage facilities shall be ample, and each shipment of packaged cement shall be kept separated to provide easy access for identification and inspection.

The Engineer may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

4. STORAGE OF AGGREGATE

The method of handling and storing concrete aggregate shall prevent contamination with foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be clear of all vegetation and level. The bottom layer of aggregate shall not be disturbed or used without recleaning.

When conditions require the use of two or more sizes of aggregates, they shall be separated to prevent intermixing. Where space is limited, stockpiles shall be separated by physical barriers.

Methods of handling aggregates during stockpiling and subsequent use shall be such that segregation will be minimized.

Unless otherwise authorized by the Engineer, all aggregate shall be stockpiled at least 24 hours to reduce the free moisture content.

5. MEASUREMENT OF MATERIALS

The measurement of the materials, except water, used in batches of concrete, shall be by weight. The fine aggregate, coarse aggregate and mineral filler shall be weighed separately. Where bulk cement is used, it shall be weighed separately, but batch weighing of sacked cement will not be required. Where sacked cement is used, the quantities of material per batch shall be based upon using full bags of cement. Batches involving the use of fractional bags will not be permitted.

Allowance shall be made for the water content in the aggregates.

Bags of cement varying more than 3 percent from the specified weight of 94 pounds may be rejected, and when the average weight per bag in any shipment, as determined by weighing 50 bags taken at random, is less than the net weight specified, the entire shipment may be rejected. If the shipment is accepted, the Engineer will adjust the concrete mix to a net weight per bag fixed by an average of all individual weights which are less than the average weight determined from the total number weighed.

6. CLASSIFICATION AND MIX DESIGN

It shall be the responsibility of the Contractor to furnish the mix design, using a coarse aggregate factor acceptable to the Engineer, for the class(es) of concrete specified. The mix shall be designed by a qualified concrete technician to conform with the requirements contained herein and in accordance with the THD Bulletin C-11. The Contractor shall perform, at his own expense, the work required to substantiate the design, except the testing of strength specimens, which will be done by the Engineer. Complete concrete design data shall be submitted to the Engineer for approval.

It shall also be the responsibility of the Contractor to determine and measure the batch quantity of each ingredient, including all water, so that the mix conforms to these specifications and any other requirements shown on the plans.

In lieu of the above mix design responsibility, the Contractor may accept a design furnished by the Engineer; however, this will not relieve the Contractor of providing concrete meeting the requirements of these specifications.

Trial batches will be made and tested using all of the proposed ingredients prior to the placing the concrete, and when the aggregate and/or brand of cement or admixture is changed. Trial batches shall be made in the mixer to be used on the job. When transit mix concrete is to be used, the trial designs will be made in a transit mixer representative of the mixers to be used. Batch size shall not be less than 50 percent of the rated mixing capacity of the truck.

Mix designs from previous or concurrent jobs may be used without trial batches if it is shown that no substantial change in any of the proposed ingredients has been made.

The coarse aggregate factor shall not be more than 0.82, except that when the voids in the coarse aggregate exceed 48 percent of the total dry loose volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor shall not be less than 0.70 for Grades 1, 2 and 3 aggregates.

If the strength required for the class of concrete being produced is not secured with the cement specified in Table 4, the Contractor may use an approved water-reducing or retarding admixture, or he shall furnish aggregates with different characteristics which will produce the required results. Additional cement may be

required or permitted as a temporary measure until the redesign is checked.

Water-reducing or retarding agents may be used with all classes of concrete at the option of the Contractor.

When water-reducing or retarding agents are used at the option of the Contractor, reduced dosage of the admixture will be permitted.

Entrained air will be required in accordance with Table 4. The concrete shall be designed to entrain 5 percent air when Grade 2 coarse aggregate is used and 6 percent when Grade 3 coarse aggregate is used. Concrete as placed in the structure shall contain the proper amount as required above with a tolerance of plus or minus 1.5 percentage points. Occasional variations beyond this tolerance will not be cause for rejection. When the quantity of entrained air is found to be above 7 percent with Grade 2 coarse aggregate or above 8 percent for Grade 3 coarse aggregate, additional test beams or cylinders will be made. If these beams or cylinders pass the minimum flexural or compressive requirements, the concrete will not be rejected because of the variation in air content.

7. CONSISTENCY

In cases where the consistency requirements cannot be satisfied without exceeding the maximum allowable amount of water, the Contractor may use, or the Engineer may require, an approved water-reducing or retarding agent, or the Contractor shall furnish additional aggregates or aggregates with different characteristics, which will produce the required results. Additional cement may be required or permitted as a temporary measure until aggregates are changed and designs checked with the different aggregates or admixture.

The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface. When field conditions are such that additional moisture is needed for the final concrete surface finishing operation, the required water shall be applied to the surface by fog spray only, and shall be held to a minimum. The concrete shall be workable, cohesive, possess satisfactory finishing qualities, and of the stiffest consistency that can be placed and vibrated into a homogenous mass. Excessive bleeding shall be avoided. Slump requirements will be as specified in Table 3.

TABLE 3
Slump Requirements

<u>Concrete Designation</u>	<u>Desired Slump</u>	<u>Max. Slump</u>
Structural Concrete:		
(1) Thin-Walled Sections (9" or less)	4 inches	5 inches
(2) Slabs, Caps, Columns, Piers, Wall Sections over 9", etc.	3 inches	4 inches
Underwater or Seal Concrete	5 inches	6 inches
Riprap, Curb, Gutter and Other Miscellaneous Concrete	2.5 inches	4 inches

NOTE: No concrete will be permitted with slump in excess of the maximums shown.

8. QUALITY OF CONCRETE

8.1 GENERAL

The concrete shall be uniform and workable. The cement content, maximum allowable water-cement ratio, the desired and maximum slump and the strength requirements of the various classes of concrete shall conform to the requirements of Table 3 and Table 4 and as required herein.

During the process of the work, the Engineer will cast test cylinders or beams as a check on the compressive or flexural strength of the concrete actually placed.

A test shall be defined as the average of the breaking strength of two cylinders or two beams, as the case may be. Specimens will be tested in accordance with TxDOT Test Methods Tex-418-A or Tex-420-A.

Test beams or cylinders will be required as specified in the contract documents. For small placements on structures such as manholes, inlets, culverts, wingwalls, etc., the Engineer may vary the number of tests to a minimum of one for each 25 cubic yards placed over a several day period.

All test specimens, beams or cylinders, representing tests for removal of forms and/or falsework shall be cured using the same methods, and under the same conditions as the concrete represented.

"Design Strength" beams and cylinders shall be cured in accordance with THD Bulletin C-11.

The Contractor shall provide and maintain curing facilities as described in THD Bulletin C-11 for the purpose of curing test specimens. Provision shall be made to maintain the water in the curing tank at temperatures between 70°F and 90°F.

When control of concrete quality is by twenty-eight-day compressive tests, job control will be by seven-day compressive tests which are shown to provide the required twenty-eight-day strength, based on results from trial batches. If the required seven-day strength is not secured with the cement specified in Table 4, changes in the batch design will be made.

TABLE 4
Classes of Concrete

Class of Concrete	Sacks Cement per C.Y. (min.)	Minimum Compressive Strength (f'c) 28-Day(psi)	Min. Beam Strength 7-Day (psi)	Maximum Water-Cement Ratio (gal/sack)	Coarse Aggregate No.
A*	5.0	3000	500***	6.5	2-4-8****
B*	4.5	2500	417	8.0	2-4-8****
C*	6.0	3600	600***	6.0	1-2-4**
D	6.0	3000	500	7.0	2-4
S	6.5	4000	570	5.0	2-4

*Entrained Air (slabs, piers and bent concrete).

**Grade 1 Coarse Aggregate may be used in foundation only (except cased drilled shafts).

***When Type II Cement is used with Class C Concrete, the 7-day beam break requirement will be 550 psi; with Class A Concrete, the minimum 7-day beam break requirement will be 460 psi.

***Permission to use Grade 8 Aggregate must have prior approval of the Engineer.

9. MIXING CONDITIONS

The concrete shall be mixed in quantities required for immediate use. Any concrete which is not in place within the limits outlined in specification Section 038000 "Concrete Structures", Article "Placing Concrete-General", shall not be used. Retamping of concrete will not be permitted.

In threatening weather, which may result in conditions that will adversely affect the quality of the concrete to be placed, the Engineer may order postponement of the work. Where work has been started and changes in weather conditions require protective measures, the Contractor shall furnish adequate shelter to protect the concrete against damage from rainfall, or from freezing temperatures. If necessary to continue operations during rainfall, the Contractor shall also provide protective coverings for the material stockpiles. Aggregate stockpiles need be covered only to the extent necessary to control the moisture conditions in the aggregates to adequately control the consistency of the concrete.

10. MIXING AND MIXING EQUIPMENT

All equipment, tools, and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work underway without excessive delays for repairs or replacements.

The mixing shall be done in a batch mixer of approved type and size that will produce uniform distribution of the material throughout the mass. Mixers may be either the revolving drum type or the revolving blade type, and shall be capable of producing concrete meeting the requirements of these specifications.

After all the ingredients are assembled in the drum, the mixing shall continue not less than 1 minute for mixers of one cubic yard or less capacity plus 15 seconds for each additional cubic yard or portion thereof.

The mixer shall operate at the speed and capacity designated by the Mixer Manufacturers Bureau of the Associated General Contractors of America. The mixer shall have a plate affixed showing the manufacturer's recommended operating data.

The absolute volume of the concrete batch shall not exceed the rated capacity of the mixer.

The entire contents of the drum shall be discharged before any materials are placed therein for the succeeding batch.

The first batch of concrete materials placed in the mixer for each placement shall contain an extra quantity of sand, cement and water sufficient to coat the inside surface of the drum.

Upon the cessation of mixing for any considerable length of time, the mixer shall be thoroughly cleaned.

The concrete mixer shall be equipped with an automatic timing device which is put into operation when the skip is raised to its full height and dumping. This device shall lock the discharging mechanism and prevent emptying of the mixer until all the materials have been mixed together for the minimum time required, and

it shall ring a bell after the specified time of mixing has elapsed.

The water tank shall be arranged so that the amount of water can be measured accurately, and when the tank starts to discharge, the inlet supply shall cut off automatically.

Whenever a concrete mixer is not adequate or suitable for the work, it shall be removed from the site upon a written order from the Engineer and a suitable mixer provided by the Contractor.

Pick-up and thro-over blades in the drum of the mixer which are worn down more than 10 percent in depth shall be repaired or replaced with new blades.

Improperly mixed concrete shall not be placed in the structure.

Job mix concrete shall be concrete mixed in an approved batch mixer in accordance with the requirements stated above, adjacent to the structure for which the concrete is being mixed, and moved to the placement site in non-agitating equipment.

11. READY-MIX PLANTS

11.1 GENERAL

It shall be the Contractor's responsibility to furnish concrete meeting all requirement of the governing specification sections, and concrete not meeting the slump, workability and consistency requirements of the governing specification sections shall not be placed in the structure or pavement.

Ready-Mixed Concrete shall be mixed and delivered by means of one of the following approved methods.

- (1) Mixed completely in a stationary mixer and transported to the point of delivery in a truck agitator or a truck mixer operating at truck agitator or truck mixer agitation speed. (Central-Mix Concrete)
- (2) Mixed complete in a truck mixer and transported to the placement site at mixing and/or agitating speed (Transit-Mix Concrete), subject to the following provisions:
 - (a) Truck mixers will be permitted to transport concrete to the job site at mixing speed if equipped with double actuated counters which will separate revolutions at mixing speed from total revolutions.
 - (b) Truck mixers equipped with a single actuated counter counting total revolutions of the drum shall mix the concrete at the plant not less than 50 nor more than 70 revolutions at mixing speed, transport it to the job site at agitating speed and complete the required mixing before placing the concrete.
- (3) Mixed completely in a stationery mixer and transported to the job site in approved non-agitating trucks with special bodies. This method of transporting will be permitted for concrete pavement only.

11.2 EQUIPMENT

(1) Batching Plant

The batching plant shall be provided with adequate bins for batching all aggregates and materials required by the specifications.

Bulk cement shall be weighed on a scale separate from those used for other materials and in a hopper entirely free and independent of that used for weighing the aggregates.

(2) Mixers and Agitators.

- (a) General: Mixers shall be of an approved stationary or truck-type capable of combining the ingredients into a thoroughly mixed and uniform mass.

Facilities shall be provided to permit ready access to the inside of the drum for inspection, cleaning and repair of blades.

Mixers and agitators shall be subject to daily examination for changes in condition due to accumulation of hardened concrete and/or wear of blades, and any hardened concrete shall be removed before the mixer will be permitted to be used. Worn blades shall be repaired or replaced with new in accordance with the manufacturer's design and arrangement for that particular unit when any part or section is worn as much as 10 percent below the original height of the manufacturer's design.

- (b) Stationary Mixers: These shall conform to the requirements of Article "Mixing and Mixing Equipment". Truck mixers mounted on a stationary base will not be considered as a stationary mixer.

- (c) Truck Mixers: In addition, truck mixers shall comply with the following requirements:

An engine in satisfactory working condition and capable of accurately gauging the desired speed of rotation shall be mounted as an integral part of the mixing unit for the purpose of rotating the drum. Truck mixers equipped with a transmission that will govern the speed of the drum within the specified revolutions per minute (rpm) will not require a separate engine.

All truck mixers shall be equipped with actuated counters by which the proper number of revolutions of the drum, as specified in Article 11. A. above, may be readily verified. The counters shall be read and recorded at the start of mixing at mixing speeds.

Each until shall have adequate water supply and accurate metering or gauging devices for measuring the amount used.

- (d) Agitators: Concrete agitators shall be of the truck type, capable of maintaining a

thoroughly mixed and uniform concrete mass and discharging it within the same degree of uniformity specified for mixers. Agitators shall comply with all of the requirements for truck mixers, except for the actual mixing requirements.

11.3 OPERATION OF PLANT AND EQUIPMENT

Delivery of ready-mixed concrete shall equal or exceed the rate approved by the Engineer for continuous placement. In all cases, the delivery of concrete to the placement site shall assure compliance with the time limits in the applicable specification for depositing successive batches in any monolithic unit. The Contractor shall satisfy the Engineer that adequate standby trucks are available.

A standard ticket system will be used for recording concrete batching, mixing and delivery date.

Tickets will be delivered to the job inspector.

Loads arriving without ticket and/or in unsatisfactory condition shall not be used.

When a stationary mixer is used for the entire mixing operation, the mixing time for one cubic yard of concrete shall be one minute plus 15 seconds for each additional cubic yard or portion thereof. This mixing time shall start when all cement, aggregates and initial water have entered the drum. The mixer shall be charged so that some of the mixing water will enter the drum in advance of the cement and aggregate. All of the mixing water shall be in the drum by the end of the first one-fourth of the specified mixing time. Water used to flush down the blades after charging shall be accurately measured and included in the quantity of mixing water. The introduction of the initial mixing water, except blade wash down water and that permitted in this Article, shall be prior to or simultaneous with the charging of the aggregates and cement.

The loading of truck mixers shall not exceed 63 percent of the total volume of the drum. When used as an agitator only, the loading shall not exceed 80 percent of the drum volume.

When Ready-Mix Concrete is used, additional mortar (one sack cement, three parts sand and sufficient water) shall be added to the batch to coat the drum of the mixer or agitator truck, and this shall be required for every load of Class C concrete only and for the first batch from central mix plants.

A portion of the mixing water, required by the batch design to produce the desired slump, may be withheld and added at the job site, but only with permission of the Engineer and under his supervision. When water is added under the above conditions, it shall be thoroughly mixed as specified below for water added at the job site.

Mixing speed shall be attained as soon as all ingredients are in the mixer, and each complete batch (containing all the required ingredients) shall be mixed not less than 70 nor more than 100 revolutions of the drum at mixing speed except that when water is added at the job site, 25 revolutions (minimum) at mixing speed will be required to uniformly disperse the additional water throughout the mix. Mixing speed shall be as designated by the manufacturer.

All revolutions after the prescribed mixing time shall be at agitating speed. The agitating speed shall be not less than one (1) nor more than five (5) rpm. The drum shall be kept in continuous motion from the time mixing is started until the discharge is completed.

12. PLACING, CURING AND FINISHING

The placing of concrete, including construction of forms and falsework, curing and finishing, shall be in accordance with Standard Specification Section 038000 "Concrete Structures".

13. MEASUREMENT AND PAYMENT

This project is a lump sum bid. The work governed by this specification shall not be measured for pay, but shall be subsidiary to the project.

END OF SECTION

SECTION 032020
REINFORCING STEEL

1. DESCRIPTION

This specification shall govern the furnishing and placing of reinforcing steel, deformed and smooth, of the size and quantity designated on the plans and in accordance with these specifications.

2. MATERIALS

Unless otherwise designated on the plans, all bar reinforcement shall be deformed, and shall conform to ASTM Designation: A615, Grades 40, 60 and 75, and shall be open hearth, basic oxygen, or electric furnace new billet steel.

Large diameter new billet steel (Nos. 14 and 18), Grade 75, will be permitted for straight bars only.

Where bending of bar sizes No. 14 or No. 18 of Grades 40 and 60 is required, bend testing shall be performed on representative specimens as described for smaller bars in the applicable ASTM Specification. The required bend shall be 90 degrees around a pin having a diameter of 10 times the nominal diameter of the bar.

Spiral reinforcement shall be smooth (not deformed) bars or wire of the minimum diameter shown on the plans, and shall be made by one or more of the following processes: open hearth, basic oxygen, or electric furnace. Bars shall be rolled from billets reduced from ingots and shall comply with ASTM Designation: A 306, Grade 65 minimum (references to ASTM Designation: A 29 is voided). Dimensional tolerances shall be in accordance with ASTM Designation: A 615, or ASTM Designation: A 615, Grade 40 or 60, except for deformations. Wire shall be cold-drawn from rods that have been hot-rolled from billets and shall comply with ASTM Designation: A 185.

In cases where the provisions of this specification are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this specification shall govern.

Report of chemical analysis showing the percentages of carbon, manganese, phosphorus and sulphur will be required for all reinforcing steel when it is to be welded.

The nominal size and area and the theoretical weight of reinforcing steel bars covered by this specification are as follows:

<u>Bar Size Number</u>	<u>Nominal Diameter, In.</u>	<u>Nominal Area, Sq. In.</u>	<u>Weight Per Linear Foot, Pounds</u>
2	0.250	0.05	0.167
3	0.375	0.11	0.376
4	0.500	0.20	0.668
5	0.625	0.31	1.043
6	0.750	0.44	1.502
7	0.875	0.60	2.044
8	1.000	0.79	2.670
9	1.128	1.00	3.400
10	1.270	1.27	4.303
11	1.410	1.56	5.313
14	1.693	2.25	7.6
18	2.257	4.00	13.60

Smooth round bars shall be designated by size number through No. 4. Smooth bars above No. 4 shall be designated by diameter in inches.

When wire is ordered by gauge numbers, the following relation between number and diameter, in inches, shall apply unless otherwise specified:

<u>Gauge Number</u>	<u>Equivalent Diameter, Inches</u>	<u>Gauge Number</u>	<u>Equivalent Diameter, Inches</u>
0	0.3065	8	0.1620
1	0.2830	9	0.1483
2	0.2625	10	0.1350
3	0.2437	11	0.1205
4	0.2253	12	0.1055
5	0.2070	13	0.0915
6	0.1920	14	0.0800
7	0.1770		

3. BENDING

The reinforcement shall be bent cold, true to the shapes indicated on the plans. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection.

Unless otherwise shown on the plans, the inside diameter of bar bends, in terms of the nominal bar diameter (d), shall be as follows:

Bends of 90 degrees and greater in stirrups, ties and other secondary bars that enclose another bar in the bend:

	<u>Grade 40</u>	<u>Grade 60</u>
#3, #4, #5	3d	4d
#6, #7, #8	4d	5d

All bends in main bars and in secondary bars not covered above:

	<u>Grade 40</u>	<u>Grade 60</u>	<u>Grade 75</u>
#3 thru #8	5d	6d	--
#9, #10	5d	8d	--
#11	5d	8d	8d
#14, #18	10d	10d	--

4. TOLERANCES

Fabricating tolerances for bars shall be within 3 percent of specified.

5. STORING

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids or other supports, and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil, or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross-sectional area and tensile properties of a hand wire crushed specimen meets the physical requirements for size and grade of steel specified.

6. SPLICES

No splicing of bars, except when provided on the plans or specified herein, will be permitted without written approval of the Engineer.

Splices not provided for on the plans will be permitted, but not included for measurement, in Grade 40 bars only, sizes No. 8 and smaller, subject to the following:

For bars exceeding 40 feet in plan length, the center-to-center distance of splices shall not be less than 40 feet and no individual bar length shall be less than 10 feet. Splices will not be permitted in bars less than 40 feet in plan length. Splices which are not shown on the plans, but permitted hereby, shall be made in accordance with Table 1 below. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.

Splices will not be permitted in main reinforcement at points of maximum stress. When permitted in main bars, splices in adjacent bars will be staggered a minimum of two splice lengths.

TABLE 1
Minimum Lap Requirements

<u>Lap</u>	<u>Uncoated</u>	<u>Coated</u>
Lap in inches \geq	40d	60d

Where: d = bar diameter in inches

Welding of reinforcing bars may be used only where shown on the plans or as permitted herein. All welding operations, processes, equipment, materials, workmanship and inspection shall conform to the requirements of the plans and to Standard Specification Section 050200 "Welding".

All splices shall be of such dimension and character as to develop the full strength of bar being spliced.

End preparation for butt welding reinforcing bars shall be done in the field. Delivered bars shall be of sufficient length to permit this practice.

For box culvert extensions with less than one foot of fill, the existing longitudinal bars shall have a 20-diameter lap with the new bars. For extensions with more than one foot of fill, a minimum of 6 inches lap will be required.

Unless otherwise shown on the plans, dowel bars transferring tensile stresses shall have a minimum embedment equal to the minimum lap requirements shown in Table 1. Shear transfer dowels shall have a minimum embedment of 12 inches.

7. PLACING

Reinforcement shall be placed as near as possible in the position shown on the plans. Unless otherwise shown on the plans, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than one-twelfth of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than one-quarter inch. Cover of concrete to the nearest surface of steel shall meet the above requirements but shall never be less than one inch.

Vertical stirrups shall always pass around the main tension members and be attached securely thereto. The

reinforcing steel shall be spaced its required distance from the form surface by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers, or approved pre-cast mortar or concrete blocks. For approval of plastic spacers on the project, representative samples of the plastic shall show no visible indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.

All reinforcing steel shall be tied at all intersections, except that where spacing is less than one foot in each direction, alternate intersections only need be tied.

Before any concrete is placed, all mortar shall be cleaned from the reinforcement. Precast mortar or concrete blocks to be used for holding steel in position adjacent to formed surfaces shall be cast in molds meeting the approval of the Engineer and shall be cured by covering with wet burlap or cotton mats for a period of 72 hours.

The blocks shall be cast in the form of a frustum of a cone or pyramid with the smaller face placed against the forms.

A suitable tie wire shall be provided in each block, to be used for anchoring to the steel. Except in unusual cases, and when specifically otherwise authorized by the Engineer, the size of the surface to be placed adjacent to the forms shall not exceed two and one-half inches square or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be cast accurately to the thickness required, and the surface to be placed adjacent to the forms shall be a true plane free of surface imperfections.

Reinforcement shall be supported and tied in such manner that a sufficiently rigid case of steel is provided. If the cage is not adequately supported to resist settlement or floating upward of the steel, overturning of truss bars or movement in any direction during concrete placement, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to ensure compliance with the first paragraph of Article 7 of this specification.

Mats of wire fabric shall overlap each other sufficiently to maintain a uniform strength and shall be fastened securely at the ends and edges.

No concrete shall be deposited until the Engineer has inspected the placement of the reinforcing steel and given permission to proceed.

8. MEASUREMENT

Unless specified otherwise this item shall be measured as a lump sum.

9. PAYMENT

Payment shall be at the lump sum measurement. Payment shall be full compensation for all labor, material, and equipment necessary. To complete the work in accordance with the plans and this specification and shall be subsidiary to the bid item it's listed in.

END OF SECTION